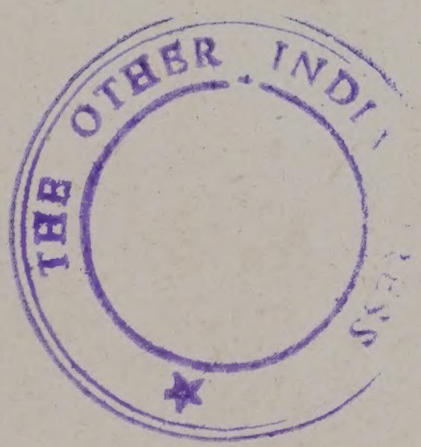
Library Edition/Other India Press Original
Not to be sold or taken away

THE TOUCH OF MIDAS

SCIENCE, VALUES AND ENVIRONMENT IN ISLAM AND THE WEST

editor ZIAUDDIN SARDAR

The touch of Midas



The Touch of Midas

Science, values and environment
in Islam and the West

Edited by Ziauddin Sardar

The Other India Press
Mapusa, Goa.

Centre for Studies on Science
Aligarh, U.P.

The Touch of Midas
Edited by Ziauddin Sardar

First published by Manchester University Press
Copyright © 1984 Ziauddin Sardar

Indian edition published by:

The Other India Press
Mapusa 403 507 Goa, India
Phone/Fax: 91-832-263305

in collaboration with

Centre for Studies on Science,
Al-Homera, Muzzammil Manzil, Dodhpur,
Aligarh 202 002, India.
Fax: 91-571-400466

OIP policy regarding environmental compensation:

5% of the list price of this book will be made available by the Other India Press to meet the costs of raising natural forests on private and community lands in order to compensate for the use of tree pulp in paper production.

Cover design by Orijit Sen

Distributed in India by:

The Other India Bookstore
Mapusa 403 507 Goa, India.
Fax: 91-832-263305
Phone: 91-832-263306

ISBN No: 81-900229-6-2

Printed by Sujit Patwardhan for the Other India Press at
MUDRA, 383, Narayan Peth, Pune 411 030 India.

Contents

Notes on the contributors vi

Introduction: Islamic and Western approaches to science
ZIAUDDIN SARDAR 1

Part one. Over-views

1 Science and Islam: is there a conflict? M. HUSAIN SADR 15
2 Rebirth of Islamic science GLYN FORD 26

Part two. Science and values

3 Science and values J. R. RAVETZ 43
4 Knowledge without science: science without knowledge
HELGA NOWOTNY 54
5 Science and technology in Islam: the underlying value system
ALI KETTANI 66
6 Islamic values and Western science: a case study of reproductive biology MUNAWAR AHMAD ANEES 91

Part three. Values and environment

7 The emergence of environmental awareness in the West
LLOYD TIMBERLAKE 123
8 Values and the built environment: a case study of British planning and urban development ALISON RAVETZ 134
9 Environment and values: the Islamic perspective
S. PARVEZ MANZOOR 150
10 Habitat and values in Islam: a conceptual formulation of an Islamic city S. GULZAR HAIDER 170

Part four. Approaching synthesis – issues and frameworks

11 Knowledge, values and world-views: a framework for synthesis
JAMES STEVE COUNELIS 211
12 Islam and the West: synthesis or 'con-fusion'?
S. PARVEZ MANZOOR 232
13 Science in Islam and the West: synthesis by dialogue
ROBERT WALGATE 240

Contributors

Munawar Ahmad Anees is a biologist particularly concerned with the ethical aspects of contemporary biology. He is the author of *Hadith and Sira Literature in Western Languages* (Bloomington, 1980) and Editor of *Studies in Islamic Medicine: the Selected Works of Sami Hamarnah* (Zahra Publications, San Antonio, 1984). He has taught at Indiana University, Bloomington, and is currently Director, Noor Health Foundation, San Antonio, Texas.

James Steve Counelis is Professor of Education at the University San Francisco. Author of a number of papers on Greek Orthodoxy, he is a regular contributor to such journals as *The Christian Scholar* and *The Greek Orthodox Theological Review*.

Glyn Ford is at the Department of the Liberal Studies of Science, the University of Manchester. He is particularly involved with his department's Programme of Policy Research in Engineering, Science and Technology (PREST) and has spent some years studying the social impact of science on the Middle East environment.

Gulzar Haider is Professor of Architecture at Carleton University, Ottawa, Canada. He is particularly interested in geometric orders and specialises in Islamic architecture. He has designed the Islamic Centres of ISNA, Plainfields, Indiana and of the University of Arkansas, Jonesboro. He is a member of the Organisation of Islamic Conference's International Commission for the Preservation of Islamic Heritage and Culture.

M. Ali Kettani is Director of the Islamic Foundation for Science and Technology for Development, Jeddah, Saudi Arabia. He has taught at American, European and Arab universities, spending some ten years as Professor of Electrical Engineering at the University of Petroleum and Minerals, Dahran, Saudi Arabia. He is a leading authority on solar energy and Muslim minorities and has published extensively on these subjects.

Parvez Manzoor is a geologist as well as a linguist specialising in Islamic arts and languages. A noted critic, he teaches at Stockholm University and is a regular contributor to the *Muslim World Book Review*.

Helga Nowotny has been preoccupied for a number of years with cognitive and social aspects in the study of science, apart from her work as

Director of the European Centre for Social Welfare in Vienna. She is the co-editor of *Counter-movements in the Sciences* (Reidel, Boston, 1979).

Alison Ravetz is an architectural historian teaching at the Department of Home Economics, Leeds Polytechnic. She is the author of *Model Estate* (Croom Helm, London, 1974) and *Remaking Cities* (Croom Helm, London, 1981).

Jerome R. Ravetz is Reader in the Department of History and Philosophy of Science, University of Leeds. He is deeply concerned with the moral and political aspects of science and technology on which he has published extensively. He is the author of *Scientific Knowledge and its Social Problems* (Oxford University Press, 1971).

M. Husain Sadar is Scientific Advisor to the Federal Environmental Assessment Review Office of the Government of Canada. He is founder and president of Canadians for the Promotion of Education and Research in Pakistan and has been an environmental consultant to NATO and UNDP.

Ziauddin Sardar is an independent scholar and journalist specialising in science and technology in the Muslim world. He is the author of *Science, Technology and Development in the Muslim World* (Croom Helm, London, 1977); *The Future of Muslim Civilization* (Croom Helm, London, 1979) and *Science and Technology in the Middle East* (Longman, London, 1982). Former Middle East Science Consultant to the *New Scientist*, he contributes regularly to a host of Western and Islamic scholarly journals.

Lloyd Timberlake is Editorial Director of Earthscan, the news and information service on development and environment issues. He is co-author of *Stockholm Plus Ten* (Earthscan, London, 1982) and a regular contributor to *People* magazine.

Robert Walgate is European Editor of *Nature*. He specialises in physics and is particularly concerned with the development of science in the Third World.

Introduction: Islamic and Western Approaches to Science

ZIAUDDIN SARDAR

In very remote times a legendary figure known as Midas reigned over Phrygia, a province of profoundly Anatolian character situated in the north-west of Asia Minor. Midas was a rather greedy monarch with an insatiable appetite for earthly riches. He persuaded the Greek deity, Dionysus, who had mystical inclinations, to grant him his wish that he might turn everything he touched into gold. No sooner did Midas have his golden touch than the water in the river Pactolus became filled with golden nuggets. But in a very short time Midas discovered that he was unable to eat his gold, and he had to beg Dionysus to withdraw the gift which condemned him to die of hunger.

Contemporary science too has the touch of Midas. It has brought mankind riches beyond dreams, freedom from diseases and conquered nature and space. But, like Midas, mankind is discovering that the golden touch has serious shortcomings. Science's ability to do a great good for mankind now seems to be overshadowed by an even greater capacity to do evil. This awareness has produced a profound sense of, to use Jean-Jacques Salomon's words, 'crises *of* science and crises *for* and *through* science'.[1]

This crisis is manifest wherever we look among the interactions of science and technology with the natural environment. Political and environmental constraints are increasingly limiting the practical solutions which previous experience has led us to think might be eminently suitable ways out of the complex and growing labyrinth of problems that scientists have created. The deeper we press into the maze, which extrapolations of our scientific progress in the last two centuries will inevitably lead us to do, the closer we get to the Minotaur. What is the nature of the beast that awaits us if we carry on as we have been doing? Many dread the answer.

Perhaps the most significant aspect of the phenomenon is the widespread bewilderment that so many problems and dilemmas should come together simultaneously. Runaway production-orientated technology, which has led to the depletion of our natural resources, the post-critical total and *per capita* pressures on land and environment, an ever-increasing output of waste matter, frightening arsenals of nuclear, chemical and biological agents are indicators of an impersonal threat to mankind's future. This threat in itself points to a crisis within science where by 'science' we understand both research and application in the total, unified system on which our daily lives depend.

Within the scientific community, the attacks being made on science are symptomatic of this crisis. A whole body of literature criticising science has been produced by scientists, and this literature is growing steadily, as are the number of organised movements of 'protesting' scientists.[2] But more:

> Apart from those taking an active part in the criticism of the scientific institution, the number of research scientists who feel themselves to be in a crisis situation has steadily increased, as if there were fewer and fewer 'happy' researchers, in the sense in which Michel Serres, expressing his indignation at the death instinct which has taken hold of science, rightly speaks of the happiness and pleasure of research. Something has happened in the history of the scientific institution which now restrains it from invoking, with the same force of conviction, the values, no less the joys, which it has proclaimed from the beginning.[3]

That 'something' is even affecting the image of the scientist in his social position and practice. The concept of 'the scientist' after the Renaissance as a dedicated, lone researcher, a quasi-religious figure analogous to a saintly hermit, is obsolete, if indeed such an idea ever had any reality. It seems obvious now that with the absence of any moral or ethical doctrine to limit the social practice and impacts of science, scientists are ill-equipped to recognise, let alone resist, the danger to the integrity of their discipline. The areas where searchers after knowledge are becoming active parties to its subversion or distortion are rapidly multiplying. Genetic engineering – the precursor of some of Huxley's *Brave New World* – is promised to be intensely powerful and beneficial for industry and yet so harmless as to need no serious regulation. Microprocessors will lead to mass redundancy among human workers and the convulsion of all industrially based society, and yet the scientific community permits only anodyne reassurances to be given to the public.

Such developments have led concerned scientists to suggest, with increasing clarity and assertiveness, that science must reconstruct itself by a conscious re-examination of its value structure and relationship to society. They have argued that it is no longer tenable for the scientist to take refuge in the convenient claim that his subject is value-free, that

> 'science is an activity of human beings acting and interacting, thus a social activity. Its knowledge, its statements, its techniques have been created by human beings and developed, nurtured and shared among groups of human beings. Scientific knowledge is therefore fundamentally social knowledge. As a social activity, science is clearly a product of history and of processes which occurred in time and place and involved human actors. These actors had lives not only in science, but in the wider societies of which they were a part.[4]

As such, neither scientists nor science can be separated from social and humanitarian concerns. There is no divorce of science from values, and never has been. There is no Platonic 'Form' which the scientists as a latter-day 'philosopher-king' alone can see. Knowledge, methodology, process, technique, and cultural and environmental context cannot continue to exist – as far as the scientist is concerned – in separate, watertight compartments.

This new understanding of science also has another dimension. The human approach to studying, explaining and interacting with nature has certainly not been uniform through time or across cultures. As Marxist historians of science repeatedly point out, it has not even been the same for all groups or classes within a single culture or society. There is a great deal to be learnt, new insights to be made, by studying and appreciating how other non-Western cultures perceived science and the role it played in their societies.

Stimulated by these concerns and insights, which conveniently have coincided chronologically with the post-colonial rediscovery of Islamic identity, Muslim scientists have begun to look again at the richness that was Islamic science. There is an increasing interest amongst the scientists in the Muslim world with Islamic science both in its historical aspect and contemporary application.[5] The history and development of science under Islam – indeed, it was the Muslims who gave science its recognisable form – have received a great impetus recently and a number of institutes for the history of Islamic science have been established over the last few years. But, coincident with the concern over scientific ethics in the West, Muslim scientists have started to ask whether it is possible to recapture the style and spirit of Islamic science in our age. As the epistemologies of al-Ghazzali and ibn Khaldun show, values and moral principles played an important part in the Muslims' pursuit of knowledge. Contemporary Muslim scientists want to know whether these epistemologies can be incorporated both in the science policies of Muslim countries and in the scientists' own everyday work and research. These questions are not easy to answer, but quintessentially the matter is a manifestation of the classical Muslim quest to synthesise the sacred with the profane.

The present book sets out to examine whether a synthesis can be achieved between the growing awareness of a crisis in science in the West and the various attempts to rediscover the spirit of Islamic science in the Muslim world. It is based on two seminars which were held in Stockholm (24–7 September 1981) and Granada (31 May–2 June 1982) under the general theme of 'science and technology in Islam and the west: a synthesis', and sponsored jointly by the International Federation for the Institutes of Advance Study (IFIAS) and Islam and the West International. The Stockholm seminar focused on 'Knowledge and values', while the

Granada seminar concerned itself with 'Environment and habitat'[6]. The essential idea behind the seminars was to study science as a human activity and encompass the historical and the sociological perspectives and thus be comparative in mode.

The overall intellectual framework of the seminars, and indeed this book, was based on appreciating two basic assumptions. The first is briefly outlined by Husain Sadr. There is no dichotomy or conflict between Islam and science – the hostility between institutionalised Christianity and science has no parallel in Islamic history. On the contrary, Islam, as manifested in the Qur'an and the teachings of Prophet Mohammad, insists on the pursuit of knowledge. At the same time, Islam refuses to break the unity of thought in the face of economy and politics, science and technology, religion and society: the epistemology of Islam is the matrix that webs all the elements in a single orientation, based on the human soul. Sadr argues that Islam is a total system: 'it is a religion, a culture, a civilisation – all at once. And as a holistic system it touches every aspect of human endeavour. Islamic ethics and values permeate all human activity.' And, as such, Islam has a definite perspective – philosophical, sociological and methodological – on science and technology.

The second assumption is elaborated by Glyn Ford. In a post-Kuhn world it is untenable to argue that science is neutral and value-free. From this basic premise Ford argues:

> if science is not the unique intellectual construct, which until so recently it was portrayed, if the history of science is not the history of iterative movements towards the truth about the natural world, but rather the history of various social constructions of reality mediated through science, scientists and society, then there exists the possibility of an Islamic science that will be one, or more likely a series of facets of a multi-dimensional world of nature, all of which are imbued with the very essence of Islamic society.

Enlightened scientists of both cultures will have no problem with the arguments of Sadr and Ford. Indeed, al-Farabi, who lived between 870–950 CE, would have liked to elaborate on Einstein's observations that 'science without religion is lame, religion without science is blind'. Respect for other cultures and social responsibility of scientists was of fundamental concern to both men, even if they were separated by a thousand years. Admittedly, Einstein would find it a little more difficult to explain quantum mechanics to al-Farabi than the latter to outline his definition of happiness. But al-Farabi would have no difficulty in appreciating the paradoxes of science and values that Ravetz has outlined so brilliantly.

Ravetz, who in the early seventies led the movement for the criticism of

science, points out in his essay in 'Science and values' that scientists have had the experience, in Oppenheimer's words, of 'tasting sin' and are doubtlessly finding it sweet. For Ravetz, the basic assumptions of science, that reason is supreme, nature is there to be dominated, the purpose of science is to solve all problems, are arrogantly frightening. These are the assumptions of the Enlightenment. And, in Arnold Toynbee's words, they are the embodiments of the 'post-Christian' Western actions and intellectual traditions that developed in seventeenth, eighteenth and nineteenth-century Europe and were stimulated by the rabid anticlericalism that arose after the French revolution. In this framework, Ravetz argues, the ethic of scientific truth is an absolute value which must not be compromised. 'Yet, by some alchemy of logic, this value-free truth becomes the foundation of human values.' Combine this system of science, warns Revetz, with a technology which relies on a 'hidden hand' for its proper shaping and direction, and you have a recipe for destroying systems of human practice and belief which rest on another foundation.

In Ravetz's analysis, science is a dominating, arrogant world-view. But in her essay 'knowledge without science – science without knowledge' Helga Nowotny argues that science's claim of offering a world-view cannot be substantiated. Scientific rationality is so bankrupt, she argues, that it cannot offer 'directions for human conduct, nor construct the kind of symbolic meanings which are an essential and indispensible part of human communication'. Nowotny criticises the humanist critics of science, like Ravetz, for misdirecting their energy and attacking the alleged value-freeness of science and thus becoming the victims of the 'rhetoric of science'.

In a concise and forceful essay, Nowotny argues that science has completed its programme of 'inner colonialisation' and is now ready to drop its protective shield of providing well-being for all, as 80 per cent of its research and development budget is directed towards military objectives. We are now forced to realise that science and technology cannot be separated from their applications, use and abuse; neither can they be divorced from the social forces that are inherent in them. Moreover, science is increasingly leaving knowledge behind, as information becomes the predominant source of infusing power.

However, both Ravetz and Nowotny agree that science and technology have to be shaped by more enlightened values. And both ask: which values and whose values? Nowotny goes further and asks: can Muslim scientists with an intact epistemology synthesis science and knowledge? And she spells out the challenge:

> The institutional system of Islamic science has become ossified and finally ceased to exist at all. The challenge it faces now is how to build

new institutions of science which are at the same time concordant with its traditional concept of knowledge and can face the challenge coming from the outside.

Ali Kettani, of course, has no hesitations in answering Ravetz's and Nowotny's questions. In an Islamic society the values shaping scientific and technological endeavour would have to be Islamic values. He describes how Islamic values and ideals affected the work of Muslim scientists of the Golden Age of Islam and identifies five main characteristics of this period: universalism, tolerance, international character of the market, respect for science and scientists, and the Islamic nature of both the ends and means of science. Kettani argues that the revival of Islamic science can only be brought about by these very values. And he thinks that institutions like the Organisation of Islamic Conference (OIC) and Islamic Foundation for Science and Technology for Development (IFSTAD) are an indication that these values are finding an expression amongst Muslim peoples and their governments.

The main contribution of Kettani's papers lies in pointing out, almost in passing, that within an Islamic society there is no distinction between the ends and means of science. It is this principle that tackles Ravetz's question: how can we be sure that the pursuit of knowledge under Islam could not be abused and lead to harmful effects? And it is this very dichotomy between ends and means in Occidental science, as Munawar Ahmad Anees demonstrates so convincingly in his essay 'Islamic values and Western science: a case study of reproductive biology', which can take contemporary Islamic societies so far away from Islam.

Anees outlines Islamic thinking on reproduction and sexual roles and behaviour in some detail and contrasts it with the Western attitudes on sexuality and human nature. He describes the current state of the art of such aspects of modern reproductive biology as artificial insemination, *in vitro* fertilisation and eugenics, and discusses the value implications of biological and social parenthood and techniques of recombinant DNA. Anees' straight, matter-of-fact account leads to a logical but chilling conclusion: at least 'in the area of reproductive biology good and evil always exist side by side' and 'the value judgements required to keep on the side of the good are very subtle'. He ends by calling on Muslim scholars, scientists, technologists and jurists to give some serious thought to this area of science and assess, from the Islamic viewpoint, whether the advantages to be gained from research and development are greater than the inherent dangers.

Anees' warnings bring us back to the question of ends and means. In Islam, issues of science and values have to be treated within a framework of concepts that shape the goals of a Muslim society. These concepts

generate the basic values of an Islamic culture and form a parameter within which an ideal Islamic society develops and progresses. The Stockholm seminar on 'knowledge and values' identified ten such concepts: *tawheed* (unity), *khilafah* (trusteeship), *ibadah* (worship), *ilm* (knowledge), *halal* (praiseworthy) and *haram* (blameworthy), *adl* (social justice) and *zulm* (tyranny), *istislah* (public interest) and *dhiya* (waste). When translated into values, this system of concepts embraces the nature of scientific enquiry in its totality: it integrates facts and values and institutionalises a system of knowing that is based on accountability and social responsibility. But what do these values really mean and how do they shape scientific and technological activity?[7]

Usually, the concept of *tawheed* is translated as unity of God. It becomes an all-embracing value when this unity is asserted in the unity of mankind, unity of man and nature, and the unity of knowledge and values. From *tawheed* emerges the concept of *khilafah*: that man is not independent of God but is responsible and accountable to God for his scientific and technological activities. The trusteeship implies that man has no exclusive right to anything and that he is responsible for maintaining and preserving the integrity of the abode of his terrestrial journey. Thus the heroic concept of science, of lone scientists out to conquer and dominate nature at all costs, has no place in this framework.

Now, if man is not to seek knowledge for the outright exploitation and domination of nature, is he simply reduced to a passive observer? On the contrary, contemplation (*ibadah*) is an obligation, for it leads to an awareness of *tawheed* and *khilafah*; and it is this very contemplation that serves as an integrating factor for scientific activity and system of Islamic values. *Ibadah*, or the contemplation of the unity of God, has many manifestations of which the pursuit of knowledge is the major one.

But is the pursuit of all knowledge *ibadah*? The concept of knowledge, *ilm*, which is a value when it is pursued within an Islamic framework, is one of the most written-about and discussed concepts of Islam.[8] There are more than 1,200 definitions of *ilm*, and almost all Muslim classical authors from al-Kindi (d. 873), al-Farabi (d. 950) and al-Biruni (d. 1048) to ibn Khaldun (d. 1406) have produced major classifications of knowledge. In general, *ilm* is divided into two categories: revealed knowledge, which provides the ethical and moral framework, and non-revealed, the pursuit of which is an obligation under the dictates of *ibadah*. Non-revealed knowledge is further sub-divided into two categories: *fard-ayan*, such as ethics and morality, which is essential for individuals to survive, and *fard kifayah* which is necessary for the survival of the whole community. The pursuit of knowledge for the benefit of the individual or the community is *ibadah*. The notions of science for science's sake and science as a means to an end are rejected.

What determines the social responsiveness and non-utilitarian nature of science? Here the concept of *halal* and *haram* come into play. When closely examined, *haram* includes all that is destructive for man as an individual, his immediate environment and the environment at large. The word destructive should be understood in its physical, mental and spiritual sense. On the other hand, all that is beneficial for an individual, his society and his environment, is *halal*. Thus an action that is *halal* brings all-round benefit. But an action that may bring benefits for the individual may have harmful effects either on society or the environment or both. This is why *halal* operates on the premises of the distribution of *adl* (social justice). *Haram* propagates *zulm* (tyranny). Within the framework of Islamic values, *zulm* is of three categories: between man and God, between man and man, and between man and nature. Thus scientific and technological activity that seeks to promote *adl* is *halal*, while that science and technology which promotes alienation and dehumanisation, concentration of wealth in fewer and fewer hands, unemployment and environmental destruction is *zalim* (tyrannical) and therefore *haram*. A major characteristic of *zalim* science and technology is that they destroy human, environmental and spiritual resources and generate waste. Such science is therefore categorised as *dhiya* (wasteful). Scientific and technological activity that promotes *adl* – distributive technologies, science for the people – draw their legitimacy from *istislah* (public interest), which is the chief supplementary source of Islamic law.

It was such a consideration of key Islamic concepts that enabled the Stockholm seminar to produce a simple contemporary model of Islamic science: the paradigms of Islamic science are the concepts of *tawheed, khilafah and ibadah*. Within these paradigms, Islamic science operates through the agency of *ilm*, to promote *adl* and *istislah*. Thus the accountability of Muslim scientists is both social and spiritual. A natural science that develops within this framework would also promote God-consciousness, harmonise the means and ends in the production of knowledge, and emphasise social relevance in both the pursuit and application of knowledge.

Only such a contemporary understanding of Islamic science can lead Muslim scholars and scientists to answer the profound questions that Monawar Ahmad Anees asks about reproductive biology. And it was precisely such a framework that produced the science and scientists of the Golden Age of Islam that Ali Kettani describes so lavishly. Parvez Manzoor and Gulzar Haider take the discussion a step further: at the Granada seminar they tried to show how a contemporary understanding of key Islamic concepts can solve the problems of environment and habitat.

That the global environmental crisis confronting us is a product of modern science and technology is now accepted without much argument.

Lloyd Timberlake describes some aspects of this crisis and traces the emergence and development of the environmental movement in the West. He argues that the movement has had a considerable impact on Western society and has now become so radical that it has moved from efforts to seek consensus to confrontation with centres of power. While, in the developing countries, 'the rulers themselves seem to have slowly come to realise that their environmental problems require radical solutions and that poverty is the worst polluter'. Timberlakes' paper contains some key observations on Muslim nations. He points out the record of wealthy Muslim countries is abysmal, right across the environmental spectrum. There are three main reasons for this: oil-rich countries are trying to telescope 'a century of development into a decade', and hence seem to be importing Western technology uncritically and blindly. But more than that: 'the leaders of many wealthy Muslim nations have become completely separated from both their religion and their roots in the land.'

The same reasons can also be given for the destruction of the built environment in Muslim societies. In her elegant essay on 'Values and the built environment: a case study of British planning and urban development', Alison Ravetz exposes the nature and characteristics of Western building technology and describes some of the more prominent failures of British town planning. These ideas and models, along with Western building technology are now being profitably exported to the Muslim world, with the all too expected outcomes. However, a number of new trends initiated in the last decade spell out a more enlightened future. Public participation in planning, the 'freedom to build' movement and the trend towards conservation all contain ideas that could bring dividends for Muslim scientists and scholars, she argues.

Indeed, radical scholars and movements in the West have a great deal to teach Muslim intellectuals. Similarly, Western scholars and scientists will benefit a great deal by examining Islamic alternatives. Parvez Manzoor laments that Western scholarship has deliberately ignored discussion of Islam and has taken for granted that 'Islam, like Marxism, is a Judaeo-Christian heresy'. In his powerful and highly original essay, 'Environment and values: the Islamic alternative', he argues that Islamic scientific *Weltanschauung* is 'anti-classical' and 'if science in Islam did not lead to the same kind of development that transpired in the West, it is simply because it was never divorced from values'. Using the framework of key Islamic concepts, he constructs an Islamic theory of environment and argues that *Sharia*, the parameters of Islamic law and ethics, can be translated into environmental codes and actions that can easily tackle the problems described by Lloyd Timberlake and Alison Ravetz.

The challenge for Muslim scholars and scientists is to find mechanisms for translating Manzoor's theoretical precepts into legal and practical

action. Considering the built environment, Gulzar Haider argues that the best way to develop such mechanisms and overcome the dilemma of preserving Islamic norms and values and absorbing the beneficial aspects of western knowledge and skills is to develop 'bold and imaginative models of alternative Islamic systems'. In his analysis, normative planning is the key. And he offers a visionary model of an Islamic city based on key Islamic concepts. His environmental utopia is a goal-orientated city of trusteeship, justice and accountability, knowledge and ecological harmony, ingenuity and crafts, simplicity, humility, piety and beauty. The important point about Haider's vision is that it is deeply rooted in Islamic norms and values and it is a model Islam seeks to establish in *reality*. Haider suggests that this reality should begin by recognising that existing major world views have failed drastically; that 'simultaneity and inseparability of man, nature, ideas and institutions under One God is a more hopeful structural position than idiosyncratic plurality of mutually contradictory positions'; and that mutual rights between God, man and nature should be recognised and fulfilled.

Is there a common ground between Haider's vision, Manzoor's Islamic theory of Islamic environment, Anees' concerns about reproductive biology and Kettani's ambition to revive the main characteristics of the science of the Golden Age of Islam, and the concerns of enlightened and radical Western scholars like Ravetz, Nowotny and Timberlake? How can we synthesise the efforts for a contemporary rediscovery of Islamic science and an ever deepening crisis in Occidental science? James Steve Counelis suggests that such a synthesis needs 'a common understanding of ideas'. Using the concepts of world-views and discipline, he develops an elaborate system which reveals 'whether the particular bits of knowledge or specific moral issues are within the epistemic framework of a given worldview' and hence can be discussed and debated constructively. He demonstrates the abilities of his system on sociobiology by comparing its value implications within the Islamic and Orthodox Christian worldviews and concludes that the sociobiological image of man is a useful 'complement to the Orthodox Christian patristic understanding of man' and 'does not deny nor contradicts the Qur'an'. To describe a particular branch of knowledge such as sociobiology as *zalim* (tyrannical), Counelis asserts, Muslim scientists and scholars have 'to be able to predict in advance of the results of research whether a piece of science or technology will lead to '*adl* (social justice). This position presumes to read human "intent" from within some piece of yet-to-be-established part of knowledge'.

This is precisely the point, argues Parvaz Manzoor in his second contribution to this book, 'Islam and the West: synthesis or con-fusion?' He uncompromisingly dismisses Counelis' framework as 'a futile exercise in

spurious methodology' and finds this type of 'linear reasoning' 'extremely dangerous and, if adopted, auguring catastrophic consequences for the Muslim intellectual tradition'. For Manzoor, disciplines do not have an autonomous status but are born within the matrix of particular world-views and 'intents are prior to actions and there are no facts without values: facts are "taken" not "given", "made" not "observed"'. He finds Counelis typical of Western thinkers and his reasoning 'so abstract, preoccupied with pure disciplines, bereft of situational and contextual concreteness and so little concerned with ethics that a more "un-Islamic" model is hard to conceive'. Moreover, Manzoor states unequivocally, in a truly Islamic milieu thinkers like Edward O. Wilson, author of *Sociobiology*, 'propounding hypothetical theories of the nature of man "as a useful complement to the *Qur'anic* understanding of man" would be unthinkable'. While contending that the search for synthesis for Muslims is not just an intellectual luxury but a matter of survival, Manzoor warns that 'any facile amalgamation of the two traditions will not lead to synthesis but to "con-fusion"'.

Clearly, conventional Western thinking and logical grammar and contemporary Muslim intellectual thought are poles apart. But, as Robert Walgate demonstrates so convincingly in his reflective and thought-provoking report on the 'knowledge and values' seminar, there is a middle way. This way is synthesis by dialogue conducted within a framework of mutual respect for each others arguments, and cultural and value considerations. Walgate shows how from two seemingly contradictory positions – from 'a refreshingly simple belief that science is a fundamental good, and that the individual piety of a scientist, within a notional Islamic state, can deal with all the problems that might face science in society' to 'the secular and critical view: that science is a social activity which, just like others, responds to and is created by social and political forces' – the participants reached genuine *rapprochement*. But more than that, the dialogue took the seminar to 'the threshold of something tremendously significant: a system of values with which to understand the crisis of science in the west and to shape science and technology policies which reflect the cultural and religious imperatives of Islam'. Walgate describes this 'process of enlightenment' with some joy and points out that both Muslim and Western scientists and scholars agree that science and technology should be geared towards the production of such cherished values as social justice, public interest and trusteeship. And he concludes: 'the true struggle is to separate and see clearly knowledge and power – in *all* its earthly, cultural settings'.

The power that scientific knowledge has wielded for good is all too clear for us to see. But, as so many authors in this volume argue, the evil in the pure pursuit of knowledge without cultural and value considera-

tions is very real even though, in some cases, it may be hidden from us. This evil is like the ears of Midas, always with him but hidden by a bonnet with side-pieces, the Phrygian cap. Midas was given donkey's ears by Apollo for his bad taste in music. The cap was designed to hide the king's disgrace. However, his barber was unable to keep silent about the secret he alone knew and murmured 'King Midas has donkey's ears' to the soil, whereupon the reeds growing nearby all echoed his words.

References

1 J. J. Salomon, 'Crisis of science, crisis of society', *Science and Public Policy* 4 (5) 414–433 (1977) p. 416.

2 See J. R. Ravetz's survey 'Criticisms of science' which charts the development of this literature, in *Science, Technology and Society*, edited by I. Spiegel-Rosing and D. J. de Solla Price (Sage, London, 1977).

3 Salomon, *ibid.*, p. 419.

4 Everett Mendelsohn, 'The Social reconstruction of scientific Knowledge' in E. Mendelsohn, P. Weingart and R. Whitley (eds), *The Social Production of Scientific Knowledge* (Reidel, Dordrecht, 1977).

5 For a general survey of the growing interest in Islamic science see Ziauddin Sardar, 'A revival for Islam; a boost for science', *Nature*, 282, 354–7 (1979) and 'Can science come back to Islam?', *New Scientist*, 88, 212–16 (1980).

6 For a detailed report of the discussion at the Stockholm and Granada Seminars see my Sardar, *The Emerging Synthesis: Science and Values in Islam and the West* and *The Emerging Ethics: Environment and Values in Islam and the West* (both Islam and the West International, Geneva, 1984).

7 The exposition of these values is based on my article 'Why Islam needs Islamic science', *New Scientist*, 94, 25–8 (1982).

8 See for example F. Rosenthal, 'Muslim definitions of knowledge', in Carl Leiden (ed.), *Conflict of Traditionalism and Modernism in the Muslim Middle East* (University of Texas, Austin, 1966) and by the same author, *Knowledge Triumphant* (Brill, Leiden, 1970).

PART ONE

Over-views

I Science and Islam: is there a conflict?

M. HUSAIN SADAR

The combination of man's intellect and curiosity have provided him with irresistible motivations to know and understand the nature of his environment and the causes of its creation. It is, therefore, reasonable to assume that the scientific and religious activities started almost simultaneously with the 'Creation of Man'. The evolution of every kind of civilisation on the face of this earth, and indeed the entire human progress, has largely been based or centred on religion and science.

Since the dawn of civilisation, successive generations of human beings have been spending almost unlimited amounts of time and energy in the accumulation of wealth and in grabbing more resources and territories. Science and technology, in one form or another, have played a key role in this process. The traditional role of religion has been to emphasise the transient nature of life on this planet, slow down the senseless race for material gain and encourage the spiritual uplift of the society. Needless to say, the creation of an ideal society leading a balanced life has rarely been possible because of continuous opposition from various groups having vested interests, institutions and establishments deeply committed to material progress. This unending struggle between what are arbitrarily termed as forces of 'Good' and 'Evil' continues today and will be with us tomorrow.

Perhaps it was the study of this age-old conflict which led Ingersoll to deduce that 'religion has reduced Spain to a guitar, Italy to a handorgan and Ireland to exile'. Karl Marx went even further, brushing aside every religion by calling it 'the opium of the people'.

However, the apparent conflict of science and religion, and the consequent separation of the 'two cultures' in watertight compartments, is a uniquely Western creation. It is a result, and some would argue a natural result, of the hostilities between those who claimed to be custodians of Christianity and those who challenged their intellectual and territorial power. What institutionalised Christianity did to intellectuals and scientists of the Middle Ages is well recorded in European history. But to take an inductive leap from what was a particularly European experience and generalise it to an all-embracing conflict between 'Science' and 'Religion' is not just Eurocentric but also poor scholarship.

Such historic experiences are alien to non-European civilisations such as those of China and Islam. For in their world-views reason and revelation, science and religion, are two sides of the same coin.

It is interesting to note that from a Muslim perspective, there should be no conflict between true Christianity and science. As the Qur'ān tells us, Moses, Jesus and Mohammad all preached the same message:

> Say you: We believe in God, and in that which has been sent down on us and sent down on Abraham, Ishmael, Isaac and Jacob, and the Tribes, and that which was given to Moses and Jesus and the Prophets, of their Lord; we make no division between any of them, and to Him we surrender.[1]

But that message, so Muslims believe, has been somewhat distorted by institutionalised Christianity with the consequent dichotomy between the sacred and the profane. Recent reinterpretation of Biblical teachings by World Council of Churches and devout Christian scholars brings Christianity that much closer to Islam:

> Still, it can be argued that the Biblical faith and preaching of the Christian Gospel were necessary precautions for modern scientific and technological advances, for at least three major elements, all established in Biblical thought, were necessary before the scientific attitude could be developed.
>
> First, the Biblical view of nature itself was essential. For the man of Biblical faith, nature was de-divinized. For the 'people of the Book', everything man finds on earth, and now, in the space age, even beyond the earth, can be legitimately employed for human use and humane purposes; nothing of nature in itself is the true object of religious awe or reverence; nature, rather, is seen as the handiwork of God; even at its greatest it is looked upon as merely a pale reflection of the power and beauty of divinity. This fundamental doctrine of the subjection of nature to man is illustrated not only in the Biblical account of Creation but in the Psalms. In Ps. 8:6, for example, it is said: 'Thou hast given him (man) dominion over the works of Thy hands; Thou hast put all things under his feet.'
>
> The second important element is the Biblical view of work. This doctrine was frequently obscured through the Christian ages by Hellenic philosophic influences. It breaks through clearly, however, when the focus is put on the Bible's straightforward notion of man's nature.
>
> The human creature is not thought of as a spirit more or less imprisoned in physical matter, nor is he encouraged to 'transcend' his earthliness. Consequently, where the Biblical view holds sway there is no disparagement of the body or disdain for the uses to which the body is put, and no shame attaches to physical work.
>
> The third motif that might be sited is the Biblical view of change. The old Gods were frequently related to the seasons and to natural

phenomena like the movement of the stars – a concept of divinity fundamentally challenged by the Judaic Scripture.

The ideal of change, of doing something new, then, is central to Biblical theology. It is also a mark of modernity. For both Biblical religion and modernity repudiate the static or the fatalistic; both look upon man first as a creature capable of effecting change and, second, as responsible for his own fate, his own conduct, and the management of the world.[2]

It seems then that contemporary Christian scholars are rediscovering that Biblical teachings do not oppose, suppress or inhibit scientific thought. However, this visible tolerance has not produced a total reconciliation which could introduce badly needed moral and ethical considerations in scientific activities. But such simmering issues as gene-cloning, genetic engineering and nuclear energy and armaments will no doubt persuade Christian churches that the sacred cannot really be separated from the profane.

Islam and acquisition of knowledge

Islam, unlike modern Christianity, does not differentiate between matters of 'state' and matters of 'religion'. In this respect, Islam should not really be regarded as a religion for it is a *total* system. It is a religion, a culture, a civilisation – all at once. And as a holistic system it touches every aspect of human endeavour. Islamic ethics and values permeate all human activity. It follows then that Islam must have something to say about science and knowledge:

> Islam told the Arabs to leave their corrupt practices by recognizing the existence of their Creator, by obeying the God who built them and their world. It stated that recognizing the proper position of God in relation to man was a great advance in thinking. It claimed that God Himself is the Creator of the mind, and therefore is the ultimate source of all knowledge. Claiming that God is inseparable from man and his world, Islam negated the concept that God is a reserved Being sitting on his unreachable throne, His being actively and intimately connected with all the proceedings of this world. Thus, the Muslims felt that as God holds the keys to knowledge, man's purpose was to open the doors of ignorance by spreading this knowledge. This led them to view the entire universe as a divine gift for them to study in developing moral and intellectual strength to the utmost. In searching for knowledge, Islam strongly demanded that man study the sciences, since science itself is thought of as a divinely established system. To them, if God is the Creator of the elements on which chemistry must rely, He is also the Constructor of the solar system which the astronomer beholds, as

he is the builder of the human biological system whose mind intrigues the philosopher, and to whose physiology the physician responds.[3]

As Islam does not permit priesthood or a religious hierarchy, it commands each and every believer to seek knowledge and be aware of his/her obligations and responsibilities to society as well as God. Thus, in Islam, the pursuit of knowledge is both a personal and a social obligation. There are scores of verses in the Qur'ān advising the faithful to seek and acquire knowledge necessary for a better understanding of the Divine Message as well as the universe and everything contained in it. The first revelation to Prophet Mohammad was a command from God to read and write and gain knowledge:

Read: In the Name of thy Lord who created,
created Man of a blood-clot.
Read: And thy Lord is the Most Generous
who taught by the Pen,
taught Man, that he knew not.[4]

The Prophet Mohammad himself has repeatedly and very eloquently and forcefully emphasised the importance of acquiring knowledge. Here are a few examples of several authentic sayings:

Acquire knowledge, it enables its possessor to distinguish right from wrong; it lights the way to heaven. It is our friend in the desert, our company in solitude and companion when friendless. It guides us to happiness, it sustains us in misery, it is an ornament amongst friends and an armour against enemies.

To seek knowledge is a duty of every Muslim (male and female).

The angels offer their wings to the seeker of knowledge.

Seek knowledge even though you may have to go to China.[5]

The companions of the Prophet Mohammad and early Muslims dedicated their lives to acquiring and spreading knowledge about the religion and other spheres of life. Their solid determination and total commitment for the cause of learning and teaching is reflected in the comparison of knowledge and wealth by Ali Ibn Abu Talib, the fourth Caliph of Islam:

- Knowledge is the legacy of the prophets, wealth is the inheritence of the pharaohs. Therefore knowledge is better than wealth.

- You are to guard your wealth but knowledge guards you. So knowledge is better.

- A man of wealth has many enemies, while a man of knowledge has many friends. Hence knowledge is better.

- Knowledge is better because it increases with distribution, while wealth decreases by that act.

- Knowledge is better because a learned man is apt to be generous while a wealthy person is apt to be miserly.

- Knowledge is better because it cannot be stolen while wealth can be stolen.

- Knowledge is better because time cannot harm knowledge. But wealth rusts in the course of time and wears away.

- Knowledge is better because it is boundless while wealth is limited and you can keep account of it.

- Knowledge is better because it illuminates the mind while wealth is apt to blacken it.

- Knowledge is better because knowledge induced the humanity in our Prophet to say to God, 'We worship Thee as we are your servants,' while wealth engendered in pharaoh and Nimrod the vanity which made them claim God-head.[6]

Thus from its very inception, Islam emphasised the urgency of organising means to acquire and spread knowledge.

The beginning and spread of Islamic learning in the early days of Islam was centred around Individuals rather than schools. The content of Islamic thought was also characterized by individual effort. Certain outstanding personalities, who had learned the tradition and had built round it their own legal and theological systems, attracted students from far and near who sought knowledge from them. The first chief characteristic of this learning, therefore, and the one which has persisted throughout the Middle Ages of Islam, is the individual importance of the teacher. Connected with this central importance of the teacher is the phenomenon known as 'seeking of knowledge' (*talab al-'ilm*). Itinerant students travelled over long distances, sometimes over the length and breadth of the Muslim world, to follow the lectures of famous teachers.[7]

Recorded history now tells us how thousands upon thousands of dedicated Muslim students and scholars criss-crossed the vast land mass of the Asian, African and European continents acquiring and disseminating knowledge among Muslims and non-Muslims alike.

True, in its inception Islam, like Judaism, regarded 'the Knowledge of the Lord' as the beginning and the end of wisdom but, thanks to the progressive spirit of Islam, it for ever ceased to be the end of wisdom.[8]

Qur'ānic verses on some scientific topics

For Muslims, the source of wisdom and guidance is, of course, the Qur'ān. It is like a 'Guiding Light' to be used in following the right path to knowledge and salvation. Although the central theme of the Qur'ān is the Almighty and His Creation, it touches on a number of scientific themes. These themes are a reminder to the reader that God has given us all the abilities and the necessary faculties to understand and evaluate the natural phenomenon: 'One of Allah's signs is the creation of heavens and the earth and the diversity of your tongues and colours; most surely there are signs in this for the learned'.[9]

There are accurate Qur'ānic accounts and interpretations of several scientific principles and disciplines such as cosmogony and cosmology, astronomy, anatomy, geology, mineralogy and metallurgy, meteorology, agriculture and horticulture, animal husbandry and dairy farming, navigation and aviation, food preservation, rationing and storage. Some of the specific scientific topics mentioned in the Qur'ān are:

The nature of life itself. (Biological Sciences)
Heavens, sun, moon, stars, night, day, year. (Space and planetary sciences)
Wind, thunder, lightning, clouds, rain, hail. (Meteorology)
Oceans, rivers, streams and springs (Water resources)
Earth, mountains, rocks, metals, precious metals. (Earth sciences)
Plants, trees, vegetation, fruit, vegetables. (Plant sciences)
Domestic animals, like cattle, camels, horses, sheep and goats. (Livestock, dairy science)
Wild animals like elephants, wolves, dogs and apes. (Wild life)
Mosquitoes, locust, ants, flies, spider, honey bees, lice (entomology)
Frogs and fish (marine biology).

There are chapters named after animals and insects such as Surah *Naml* (ants), *Ankabut* (spider), *Nahl* (bees) and *Baqara* (cow). The planetary and space science are one of the most frequently discussed subjects in the Qur'ān. Here are a few examples:

And a sign for them is the night; We strip it of the
day and lo, they are in darkness.
And the sun – it runs to a fixed resting-place;
that is the ordaining of the All-mighty, the All-knowing.
And the moon – we have determined it by stations,
till it returns like an aged palm-bough.
It behoves not the sun to overtake the moon, neither
the night outstrip the day,
each swimming in a sky.[10]

It is He who made the sun a radiance,
and the moon a light,
and determined it by stations, that you
might know the number of years
and the reckoning.
God created that not save with the truth,
distinguishing the signs
to a people who know.
In the alternation of night and day, and
what God has created in the heavens and
the earth – surely there are signs for
a godfearing people.[11]

And heaven – We built it with might,
and We extend it wide.
And the earth – We spread it forth;
O excellent Smoothers!
And of everything created We two kinds;
haply you will remember.[12]

After cosmology, meteorology and biology get the most frequent mention in the Qur'ān:

Hast thou not seen how God derives the clouds, then composes them,
then converts them into a mass,
then thou seest the rain issuing out of midst of them?
And he sends down out of heaven mountains, wherein is hail,
so that He smites whom He will with it, and turns it aside
for whom He will
wellnigh the gleam of His lightning snatches away the sight.[13]
And of His signs
He shows you lightning, for fear and hope,
and that He sends down out of heaven water
and He revives the earth after it is dead.[14]

O men,
if you are in doubt as to the Uprising
surely We created you of dust
then of sperm-drop
then of blood clot,
then a lump of flesh, formed and unformed
that We may make clear to you.
And We establish in the wombs
what We will, till a stated term,
and We deliver you as infants,

then that you may come of age;
and some of you die,
and some of you are kept back
unto the vilest state of life, that after
knowing somewhat, they may know nothing.[15]

No creature is there crawling on the earth,
no bird flying with its wings,
but they are nations like unto yourself.[16]

These few examples show that the Qur'ān addresses many topics of scientific interests to persuade the believers to think, reflect, investigate and postulate. Despite the fact that God is the central theme of the Qur'ān, it never provides a figurative description of the Creator but speaks of His signs (*ayats*) around us. The direct implication of this message is that to understand and comprehend the nature of God, one must investigate, analyse and understand all aspects of His creation.

The Qur'ān repeatedly uses the expressions, 'Why do they not reflect? Why do they not ponder?'. In his seminal work, *Reconstruction of Religious Thought in Islam*, the celebrated Muslim poet and philosopher Allama Muhammad Iqbal argues that by repeatedly reminding mankind to reflect and ponder, the Qur'ān aims to 'awaken in man the consciousness of that of which nature is regarded a symbol. But the point to note is the general empirical attitude of the Qur'ān which engendered in its followers a feeling of reverence for the actual and ultimately made them the founders of modern science. It was a great point to awaken the empirical spirit in an age which renounced the visible as of no value in men's search after God'.[17] Moreover, Iqbal argues further, as scholars like al-Ghazzali and ibn Khaldun have argued before him, that *total* reflection also includes *inner* reflection; and the pursuit of knowledge should not be divorced from ethical and value criteria. And it is this consideration that makes the Qur'ānic approach to science so much different than the Western approach to science.

The Qur'ānic approach to science

We have already established that there is no conflict between Islam and science where by 'science' we understand a rational and empirical method of studying the phenomenon of nature.[18] However, a conflict can arise when science and its method is made into an all-embracing value at the expense of other values of Islam. The pursuit of knowledge in Islam is not an end in itself; it is only a means of acquiring an understanding of God and solving the problems of the Muslim community. The Qur'ān never asks believers to pursue science for science's sake: but for the sake of

understanding the *ayats*, the signs, of God and thereby understanding Him.

Moreover, the Qur'ān emphasises the fact that man is related to nature, and his God-given ability to control the forces of nature is not there to be exploited for the unrighteous desire for domination, but in the nobler interest of a free upward movement of spiritual life. The Qur'ān exhorts the believer to pursue knowledge but never to lose sight of the complete Reality:

> And He originated the creation of man
> out of clay,
> then He fashioned his progeny of an extraction of
> mean water,
> then He shaped him, and breathed His spirit in him.
> And he appointed for you hearing, and sight, and *hearts*;
> little thanks you show.[19]

So, experimental and empirical work cannot be completely divorced from one's heart, inner intuition, insight or conscience. Thus, the Qur'ān sees science within a framework of total human experience: reason and the pursuit of knowledge has a very important place in an Islamic society but it is subservient to Qur'ānic values and ethics. In this framework, reason and revelation go hand in hand.

Modern science, on the other hand, considers reason to be supreme, beyond the boundaries of ethics and values. The apostles of modern science are generally oblivious to such basic religious concepts as 'the Day of Judgement' or 'Life after Death'. These are amongst the prime values of Islam: the scientist has a responsibility both towards God and the community and he or she will be accountable before God in the Hereafter. As Raghib El Naggar says, 'the belief in a Creator makes Muslim scientists more conscious of their activities. It places their reason under the authority of a Supreme Power to whom they are responsible for all their actions. The Qur'ān says, "Whosoever kills a human being for other than man-slaughter or corruption on Earth, it shall be as if he has killed all mankind; and whosoever saves the life of one, it shall be as if he has saved the life of all mankind." We, therefore, cannot let our scientific curiosity run blind for if our activities result in a single death, even indirectly, we will be accountable for it.'[20]

The prime difference, then, between modern science and the Qur'ānic approach to science is that in Islam there is no difference between the means and ends of science. Both are subject to the ethical and value parameters of Islam. Science is an essential activity for an Islamic community, for it increases the understanding of the signs of God and hence brings the *ummah*, the world-wide Muslim community, closer to the

Creator. And as scientists are accountable to God for their activities, they are required both to serve the community and protect and promote its ethical and moral institutions. The way they use science, therefore, must reflect the values of the society they seek to serve. Thus the Qur'ānic approach to science is at once dynamic and static: it promotes reason, objectivity and the pursuit of truth and excellence, but at the same time, it places this endeavour firmly within the boundaries of Islamic ethics and values.

As I said earlier, there is no conflict nor has there ever been a conflict, between Islam and science. However, when science is ascribed certain values by its apostles a conflict will then arise between these and the values of Islam. For example, the opinions of those who argue that science must be allowed to pursue its own course, without any consideration for the problems of mankind or ethical and value criteria cannot be reconciled with the Islamic dictate that both means and ends of science must submit to Qur'ānic ideals. Similarly, those who consider that science describes all aspects of reality and exclude all other forms of experience and ways of knowing will be at odds with Islam. And so on. The conflict then is between those individuals and scientists who insist on ascribing untenable values to science and the teachings of Islam.

And it is a conflict based either on untamed arrogance or a lack of appreciation of the limits of science. For, ultimately, science teaches us the true meaning of humility and reminds us of the weaknesses and the limitations of human capacity. The Qur'ān too constantly reminds us to be cognisant of our limitations before getting carried away by the spectacle of our discoveries, rationalism and deduction:

> Does not man see that We have created him
> from a drop of semen? Yet behold! He
> (stands forth) as an open opponent.
> And he puts forth for Us a parable and
> forgets his own creation. He says: 'Who
> will give life to these bones when they have
> rotted away and become dust?'
> Say: 'He will give life to them
> Who created them for the first time! And He
> is the All-Knower of every creation.
> He who, produces for you fire out of the
> green tree, when behold! You kindle
> fire from that (tree).
> Is not He, Who created the heavens and the earth
> Able to create like thereof?
> Yes, indeed! He is All-Knowing Creator.

Verily His command, when He intends a thing, is only that He says to it, 'Be' and it is!
So glory be to Him in Whose hands is the dominion of all things and to Him you all will be returned.[21]

References

1 The Qur'ān, 2: 130.
2 John Cogley, *Religion in a Secular Society*, Pall Mall Press, London, 1968, pp. 83–4.
3 Cassim Igram, *Roots of the Natural Sciences*, Laurence Press Company, Cedar Rapids, 1981, p. 7.
4 The Qur'ān, 96: 1–5.
5 All these traditions are taken from the section on knowledge in M. Azizullah, *Glimpses of the Hadith*, Karachi, 1965, pp. 113–15.
6 From M.E. Khan, *Anecdotes from Islam*, Lahore, 1966, p. 103.
7 Fazlur Rahman, *Islam*, Anchor Books, New York, 1966, p. 226.
8 S. Khuda Baksh, *Contributions to the History of Islamic Civilization*, Lahore, undated reprint of 1936 edition, vol. 2, p. 58.
9 The Qur'ān, 30: 21.
10 *Ibid.*, 36: 38–40.
11 *Ibid.*, 10: 5–6.
12 *Ibid.*, 51:47; see also 4:9–11, 42:29, 17:44, 36:38–40.
13 *Ibid.*, 24:40.
14 *Ibid.*, 30:24.
15 *Ibid.*, 22:5.
16 *Ibid.*, 6:38; see also 45:3–5, 13:4–5, 16:10–16, 3:189–90.
17 Muhammad Iqbal, *Reconstruction of the Religious Thought in Islam*, Ashraf, Lahore, 1971 reprint, p. 14.
18 For further discussion of science and Islam see M.H. Sadr, 'An Islamic View of Science', *Pakistan Journal of Science*, 31, pp. 3–6 (1979); See also: Muhammad Akbar, 'Science and Islam', *Pakistan Review*, 19(6), pp. 20–22 (1971); Sayed J. Naqvi, 'Science and the Religion of Islam', *Al-Ittihad*, 14 (1–2), pp. 26–30 (1977); M. Raziuddin Siddiqui, 'Religion and Science', *Islamic Order*, 3 (3), pp. 38–44 (1981); and Mahmood Abu Saud, 'Science and Islamic Resurgence', *The Muslim Scientist*, 9 (3–4), pp. 1–9 (1980).
19 The Qur'ān, 32: 7–9.
20 Quoted by Ziauddin Sardar, 'A Revival for Islam, A Boost for Science', *Nature* 282, pp. 354–7 (1979).
21 The Qur'ān, 36: 77–83

2 Rebirth of Islamic science GLYN FORD

> And now, what will become of us without barbarians?
> They were a kind of solution.
>
> C.P. Cavafy[1]

Science and technology in their current manifestation pose a profound threat to the future of mankind. While this threat has its clearest form in the shadow of the nuclear bomb, there are the no less dangerous problems of environmental destruction, and community disintegration. A break with the present dominant trends requires new ways of perceiving and handling the natural world and *dar al islam* has much to contribute. Historically it has done this, although few seem aware of it, and an opportunity exists to do it again.

Yet the idea that Western science and technology are the unavoidable truth about the world, has mesmerised mankind for a hundred years and more, and helped to create this crisis. This view of science as 'objective truth' is a *myth* that serves a political purpose. *Science and technology are not neutral, but value-laden.* They carry the values of the West into everywhere and everything they penetrate; as the Trojan horse brought the Greeks into Troy. Until this is recognised the vicious circle of technology creating problems that more technology is imported to solve will continue. For the Third World has found to its cost that imported technologies bring with them an inexorable logic that forces the pace of change along a narrow Western path.

Yet modern historiography of science is beginning to show that alternative sciences did exist. However, Western historians of science had rewritten this past to sanitise it for their own purposes. For while these historians had not met in solemn conclave to conspire together, their shared values and social situations produced an essential unity of thought. In attempting to reclaim this past, Islamic scientists can gain confidence to change their future.

Islamic culture has shared the fate of all non-Western cultures in the hands of the few who arbitrate upon these issues and set the fashion from their havens within the major cities of the industrialised world. This intellectual imperialism is especially potent in relation to 'science' for a number of reasons, which will be discussed below. The history of Islamic science had been re-read in the language of Western values and as a consequence it has been damned with faint praise. Its aims have been axiomatically assumed to parallel those of Western science and its major achievements have been written down as mere footnotes to the Greek

classics. Islamic science's prime function has been presented as that of a preserving medium in which the science of antiquity was stored during these unfortunate centuries when Europe forgot its destiny. Thus, when Europe's temporary amnesia ended with the Renaissance, Islamic science had fulfilled its preordained mission of short-term custodianship and passed the torch of civilisation – the texts and techniques of Greek science – back to its rightful owners. This view is pervasive outside the West itself. The inaugural issue of *The Journal for the History of Arabic Science*[2] had a statement explaining the new journals aims that merely qualified this view as neglectful of the contribution of Islamic culture, rather than fundamentally dissenting from it. At its worst this 'formaldehyde' analysis of Islamic science then attempts to cleanse this science of its Islamic content completely.

Yet there was an Islamic science worthy of an independent existence that dealt with the questions raised within its own framework of ideas. To reclaim the possibility of an Islamic science that is more than what Muslims discover *qua* Western scientists operating within the framework of values and concerns of the West, it is important to explain how this myth arose and how it became universally accepted. For unless this can be done, and the lessons of recent philosophical advances accepted, the same intellectual straitjacket will prevent any rebirth within the era of late capitalism.

This myth and its acceptance had behind it a combination of economic, political and even technical causes. A key one was the legacy of imperialism with its subjection of the 'less developed' world by the industrialising nations. For the subjection was not only a political and economic phenomenon but also a cultural one. Western prestige and power led to a self-abnegation, within the Third World, of all aspects of indigenous culture. This was especially true of science and technology. For it was here that the cultural clash was most direct, and most weighted in favour of the West. Western military technology decisively proved its superiority again and again as the European nations painted the globe in their various national hues. The result was that Western technical advisers began to litter the court circles of the Middle East and elsewhere. In many cases, the courts wanted their influence strictly contained within the military sphere. But this was a barrier that was impossible to hold. The technology itself required a skilled 'workforce', and it was therefore necessary to send suitable candidates abroad to receive appropriate technical training. When these neophytes returned from the imperial homeland and took their place as junior officers they began to want to generalise the application of what they had learnt outside the military sphere. The power of Western exemplars meant that the demand for 'modernisation' swept all before it.[3]

Most important, this was at a time when Western culture was becoming increasingly secularised as the progress of the war between science and religion entailed the steady surrender of intellectual spheres of influence by the sacred into the hands of the profane. Science was the pursuit of objective truth. This belief meant that Western science – and who was to deny its claims? – took precedence over all other realms of knowledge. Inevitably, therefore, the only value of scientific achievements outside its limits was either as caretaker or precursor, where it had anticipated the future findings of occidental science.

This myth can be destroyed creating an opportunity for an appropriate science for the Muslim world. There is now a conjunction of circumstances that allows this to be done. Western colonialism, both formally and informally, is weaker than it has been this century. The demands for national liberation after the Second World War has led to the break-up of empire, and the post-1973 economic independence of much of *dar al islam* has weakened, or even in some cases reversed, the hierarchy of informal subordination. Intellectually a similar process has occurred with long-held truths of the West's *Weltanschauung* being sceptically reappraised. Here is not the appropriate place to discuss the causes, but the air of righteous self-confidence among the Western intelligentsia has given way to scepticism and doubt. This is not unconnected with the darker results of Western industrialisation, the direct product of its science and technology.

The material conditions for 'opening' the West's intellectual hegemony are a necessary aspect of developments, but they are by no means sufficient. For at the same time an alternative frameworks for thought must be available. In re-evaluating science with hindsight, two key events in the history of ideas offer to legitimate the existence of culturally dependent sciences as facets of the complex world of nature.

The earlier of these was the transformation of the methodology of history, which took place between the two World Wars. The second was the much more recent changed perception of the nature of science itself among both some of its practitioners and philosophers. Unfortunately, these two developments – although both consequent upon the same change of tenor within the world – came in the wrong order for them to be smoothly integrated by historians of science into their discipline. Until recently the former was ruled by the historians to be uniquely inapplicable to the history of science because of the belief they held about the nature of science. For them science, unlike other disciplines, was the pursuit of an objective truth. Thus, the history of science was unique as a form of history, being little, if anything, more than a chronicle of the mapping of this objective reality. This view of the special nature of scientific enquiry, as was mentioned above, is no longer taken for granted. It is these changes

which create an opportunity for the re-evaluation and rebirth of Islamic and other non-Western sciences.

History transformed

This first event was, in epitome, the restructuring of the 'Whig, scissors and paste' history of the nineteenth century into the analytical history of today. The former was characterised by both its subject matter and its construction. It studied the past with reference to the present. As Butterfield wrote, 'though there may be a sense in which this is unobjectionable if its implications are carefully considered, and there may be a sense in which it is inescapable, it has often been an obstruction to historical understanding because it has been taken to mean the study of the past with direct and perpetual reference to the present. Through this system of immediate reference to the present day, historical personages can easily and irresistibly be classed into the men who furthered progress and the men who tried to hinder it.'[4] Thus Whig history stood at the summit of time organising the past from the point of view of the present. It was built up from raw materials quarried from original sources and rearranged to form a diachronous picture of development those lacunae were covered by the interpolations of linking narrative.

Thus history was atomised into its constituent 'facts' and these were winnowed by the winds of progress. What remained were the components of a well rounded and polished portrayal of the origins of the present. This subsidiary element was a fetish, a cult, of facts. The empiricist derivation supposed a complete separation between subject and object. Thus history was a corpus of ascertained facts. As E.H. Carr wrote, 'The historian collects them, takes them home, and cooks and serves them in whatever style appeals to him.'[5] The style of serving was as a demonstration of apparently infinite progress towards higher things, and despite claims to the contrary implied a rigid set of selection criteria as to what constituted a fact and what did not. Clearly if mundane history became a glorification, and self-justification of the *status quo*, how much truer was this of science history where the facts themselves are up-dated and where the achievements of one's predecessors are mere steps on which to stand.

This kind of history has been replaced by one which is less egocentric, more analytical and less cavalier. Many historians contributed towards this change to studying the past in its own terms, including Croce, the Italian historian, and many others. While social, economic and political historians found that the belief that the present was the key to the past was relatively easy to put aside, how was this undertaken in methodological terms?

This may be illustrated by looking at the ideas of R.G. Collingwood (1889–1943), the only British thinker in the present century who has made

a serious contribution to the philosophy of history, and who was one of the earliest and clearest exponents of these ideas. The choice of Collingwood as a model is made because of the clarity with which he expressed his ideas, even though he did not live to write the systematic treatise he planned, and because he was one of only a small number of philosopher historians who showed any interest in the history of sciences. His methodology, as expounded in his posthumous collection of writings, *The Idea of History*,[6] rested upon three concepts: (1) the logic of question and answer, (2) the notion of historical evidence and (3) the leitmotif of development.

1 Francis Bacon wrote that it was the duty of scientists to 'put nature to the question'. Collingwood in parallel demanded that historians subject history to interrogation. The trial was for the purpose of determining the questions to which the events of history were the answers and to establish the problems motivating its actors, rather than to merely superimpose those of today. The interrogation was conducted within the mind of the historian as an iterative process, the historian asking him/herself a series of consequential questions.

   For like a detective investigation (a particularly apt analogy, for the success of the investigation depends upon getting into someone else's mind), every step of the argument depends on asking a question. The question is the charge of gas, exploded in the cylinder head, which is the motive force of every piston-stroke. But the metaphor is not fully adequate because each new piston-stroke is produced not by exploding another charge of the same old mixture but by exploding a charge of a new kind. No one with any grasp of method will go on asking the same questions all the time, 'Who killed John Doe?' One asks a new question, every time. And it is not enough to cover the ground by having a catalogue of all the questions that have to be asked and asking every one of them sooner or later: they must be asked in the right order.

2 History is an activity whose business is to study events no longer open to our direct observation. These events must therefore be studied inferentially, arguing from the 'evidence' available. This is how questions like, 'Did Hitler commit suicide?', 'Why did the Romans withdraw from Britain?' and 'What problems were Jabir ibn Hayyan, Muhammad ibn Musa al-Khuwarizimi and Al-Farabi trying to solve when they were doing science?', for which we have no direct evidence, must be handled. Any relic from the past has a potential for providing evidence hidden within it. It is the job of the historian to trigger such a release by his questioning addressed to the evidence. The culture within which events occur determine the frame of values within which the questions are formulated.

3 The concept of development is one of 'arising'. Any step forward

involves a simultaneous step backwards. Human history is a seamless web containing no sharp breaks. It is unbroken, but it is not the continuity of the straight line scoring its way across the page, but rather than that of an irregular spiral. All changes involve dual opposing movements. A new development arises by a return to an old position which is transposed to a higher level. It is thus simultaneously old and new. Old in its nature, new in its transformation.

These three concepts form in themselves a unity and a justification. The third gives history a role in intellectual life which wishes to interact with the world, the second allows evidence, apart from the purely mundane kind, to be available to the historian, while the first gives a method which can generate such evidence. Perhaps some trivial examples of Collingwood's methodology at work will help. One rather simple example is the problem of why did Julius Caesar invade Britain twice, a question rarely asked by historians. No evidence exists apart from Caesar's own narrative in the *Commentaries* which nowhere says what his intention was. This concealment itself suggests that Caesar failed in his objective. Thus his intention must have been more than a mere punitive expedition or demonstration of force. A comparison of the strength of his expeditionary force with that sent over by Claudius nearly a century later shows that it was consistent with an attempt to conquer the country completely.

Thus an event for which no direct evidence exists can be explained in a manner which is entirely consistent with the information available and which goes beyond the 'scissors and paste' history that implies nothing can be said about a subject without *direct* evidence. Collingwood and other historians in related schools would claim that by such an approach they can distance themselves sufficiently, although obviously not entirely, from the present so as to begin to explain the past in its own terms.

If science, like other intellectual disciplines, is culturally determined, then such an approach can be applied to its history. Thus an evaluation can be made of Islamic science that uses as its framework the particular problems and concerns of the period and environment and its successes and failures can be measured in its own terms, rather than by criteria alien, in many senses, to the concerns of its practitioners. This would be a radical departure for the historiography of science within Islam. To date, the controversy in this area has been limited to a purely quantitative dispute. At one extreme many historians of science have all but ignored the contribution of Muslim scientists to the development of the discipline; Dampier and Bernal on two political extremes both fall to greater or lesser extents in this camp. To be fair, Bernal's *Social Function of Science* and his rather overgeneralised *Science in History* did recognise the class structure of science, but it went no further.[7] This was partly redressed by

George Sarton's *An Introduction to the History of Science*[8] which set out in great detail the achievements of the Muslim scientists in foreseeing and anticipating elements and theories of Western science, and forms the other end of the spectrum. Here it is being suggested that Islamic science can be viewed from an entirely different perspective. Obviously a close corollary of this is that once the existence of such a science can be shown, then the lessons can be applied to the re-creation of sciences today in *dar al islam* that embody the concerns and values of Islam itself, instead of apeing those of the West, which have so lamentably failed to deal with the issues facing mankind. However, all this presupposes the results of recent scholarship in the philosophy of science.

Is science neutral?

The twentieth-century doubts and worries about the inevitability of progress, which helped to give birth to the new history, have recently touched science. The rather sterile work of those logicians and mechanics that comprised the philosophy of science community until this time received two intellectual blows. These originally emanated from two individuals, Karl Popper and Thomas Kuhn.

The first of these, Popper, was concerned that the methodology of science with its aim of 'proving' theories rested upon a logical fallacy.[9] For no number, however large, of confirming instances supporting a proposition can *prove* that the next will not confound all those that went before. This threatened to undermine the notion of science as a rational enterprise, and was already being exploited by unfalsifiable pseudo-sciences such as Marxism and psychoanalysis that were claiming the legitimacy of sciences of themselves and were capable of assimilating any and all events as yet further confirmations of their veracity. Popper's response was to propose a 'technical fix' that would get around the inherent illogicality. For him the driving force behind science was no longer to be confirmation, but rather *refutation*. Scientists should proceed by advancing, along with their hypotheses, a series of tests that could prove these to be false; and should then rigorously apply them until the theory fell, giving rise to a new theory of greater explanatory power that would be tested in a similar way.

Certainly Popper's ideas, and here there is only the briefest summary, are of some value to the working scientist in avoiding some of the pitfalls of theory development. Nevertheless, at a strategic level of long-term scientific development, they are at best prescriptive of what should occur but in fact does not, and at worst dangerous in that their rigid application could prevent rather than promote scientific changes that were radical rather than merely incremental additions to what had gone before.

For many it has been the second of these philosophers, Thomas Kuhn,

who has proved crucial. Kuhn, in a survey of the history of science, claimed that two very different and alternating types of scientific practice were to be found. These he termed 'normal' and 'revolutionary' science respectively.[10] The first of these is what the vast majority of scientists undertake all of the time and all scientists do most of the time. It is the refined articulation of scientific ideas within a rigid framework of accepted practices and beliefs about nature that remain unquestioned. Thus for example Ptolemaic astronomy had, as aspects of its framework, a geocentric universe where the celestial bodies moved in perfect circles. This kind of matrix determines the kinds of problems investigated; the style in which solutions to these puzzles are offered; and the criteria of acceptability that these solutions have to meet. This framework of fundamental beliefs and accepted practices Kuhn termed a paradigm. By definition during periods of normal science the ruling paradigm in a particular field remains inviolate.

However, eventually progress within any template falters. The paradigm itself ceases to pose interesting questions, and anomalies are discovered that resist persistent attempts to incorporate them within the accepted framework. A crisis begins to develop with normal science, which is not speedily brought under control by the successful spiriting away of anomalies, forces some individual scientists to call into question the paradigm itself in an attempt to make explicable those elements of nature they consider important but outside the pale of the current paradigm's explanatory powers. This is revolutionary science. The crisis acts like rain in the Sahara. A desert blooming of alternative paradigms takes place, all of which threatens to cast into oblivion much of the work undertaken as normal science under the previous paradigm. This is obviously resisted by those whose life's work is threatened with extinction. They persist in attempting *ad hoc* modifications of what went before.

The period of revolutionary science is short-lived. It is not long before scientists begin to group themselves behind one or other of the new alternatives, and very rapidly these options mercilessly start to narrow as they compete with each other for survival; until to remain a scientist one must subscribe to *the* new paradigm within whose limits normal science recommences. This period of revolutionary science is one in which 'survival of the fittest' operates to its limits: only one survives. The test of fitness here is that the new paradigm must make explicable those facets of nature whose understanding is important to the scientists of the period.

The most important point is that Kuhn contends that the selection of the new paradigm, when in a period of revolutionary science the process of resolving the options down to one new underpinning schema is occurring, is not free from the influence of personal and partisan considerations on the part of scientists. For Kuhn believes that, in the last analysis, there

is no unambiguous scientific test that enables individual scientists to choose between competing paradigms. These, to use his own terminology, are incommensurable. It is at this point that the belief of science as objective, neutral and value-free collapses. For with personal and partisan considerations influencing paradigm choice, science clearly loses its claimed unique character. Scientists are part of society. Their personal beliefs reflect those of the society in which they live and the important issues they wish science to handle are thus not independent of social values. Thus science is society.

In 1931 Boris Hessen wrote a paper, 'The Social and Economic Roots of Newton's Principia', in which he argued from a Marxist standpoint that the *Principia* was not an isolated product of scientific genius generated by the internal logic of science alone, but rather had emerged as a consequence of the needs of the developing British bourgeoisie.[11] This materialist analysis indicates the style of arguments science is opened to by Kuhn, although of course man's motives are not only a product of economics, but also religion, morality and ideology that fall outside the naive purview of Marxism.

Since 1962, when the first edition of Kuhn's *The Structure of Scientific Revolutions* was published, a furious dispute has taken place among philosophers of science.[12] And interestingly enough this quarrel itself exhibits many of the irrational characteristics Kuhn – to his opponents' great chagrin – suggests are exhibited in paradigm choice. Claims that his work is a vindication of irrational behaviour and that it threatens, almost, the foundations of Western civilisation has forced Kuhn to recant to a degree. He has taken the step of denying the logic of his own arguments in the face of scientific indignation and abandoned some of his erstwhile disciplines. In effect following the famous precedent of Marx, he has declared himself a non-Kuhnian. This has not stopped others going further. Some have proclaimed anarchy in science[13] while others have declared that there is an ideology of and in science.[14] But one does not have to go so far to recognise that the position of science in the world has changed. Now that Kuhn has removed the blinkers, the fact that science is not neutral and value-free emerges clearly from the fog of accepted dogma. As Huxley said of Darwin's *Origin of Species*, 'How stupid not to have thought of it before.' The Lysenko affair in Russia in the 1930s is just one example,[15] while others are available from the history of non-Western sciences.[16]

Islamic science

To put it at its simplest: if science is not the unique intellectual construct which until so recently it was portrayed, if the history of science is not the history of iterative movements towards the truth about the natural world

but rather the history of various social constructions of reality mediated through science, scientists and society, then there exists the possibility of an Islamic science that will be one facet, or more likely a series of facets, of a multi-dimensional world of nature, all of which are imbued with the very essence of Islamic society. In this it only parallels those commonly accepted links between culture and society exclusive of science. For example the development and evolution of Islamic calligraphy can be shown to be mediated through societal changes. Early Kufic in its simplicity and austerity reflects the puritanism of the century following the death of Prophet Muhammad, while the coming of a more settled urban existence is shown as this gives way to the dynamic and workmanlike Nashki. As Muslim society began to stagnate so did the ponderous and sombre Thuluth Script arrive.[17] Just as with the development of calligraphy, it is not possible to divorce Islamic science and society from one another.

Thus Islamic science could be evaluated in its own terms rather than as just an aberrant sub-species of Western science. This evaluation will have much to contribute to the style in which a rebirth of Islamic science could be promoted in the future. This evaluation will require an analysis of the history of Islamic science before it succumbs to Western cultural imperialism as the answers to questions posed within its own framework, rather than cripple its rich promise by forcing it into the mould of Western thought patterns and concerns. For it is here that Islamic science will have already shown its distinct concerns and will illustrate, albeit not fully, the elements which may constitute a new Islamic science.

What would such a re-evaluation look like? We can obtain some idea by looking at the work of Seyyid Hossein Nasr. Nasr is not an ideal example, because of the strong elements of Sufi theology within his beliefs. However, if this can be borne in mind, Nasr's *Islamic Science: an Illustrated Study*[18] shows one picture. He maintains that historically there was a distinct Islamic science that was separate from, but related to, its origins. For him all ideas entering the citadel of Islamic thought from outside, including the Greek scientific heritage, were transposed into a new spiritual and intellectual form capable of meshing into the Islamic world picture.

The structure of this world picture was pre-determined by its theory of knowledge and it was this theory of knowledge which shaped the science of *dar al-islam*. Nasr believes that for Muslims there were a number of kinds of knowledge. There was 'acquired' knowledge in its twin forms of the transmitted and the intellectual sciences, and the 'presential' knowledge of vision and experience. In the West it would be maintained today that the form of knowledge termed intellectual science is, if not the only form of knowledge, that against which all others must be compared. Yet for the Muslim, these different forms of knowledge were all of equal

standing locked within a metaphysical hierarchy whose source was the Qur'ān and whose totality was a unity. Hence the quest for all knowledge was impregnated with a religious aura. This was the frame that determined both the problems the Muslim scientist tried to solve and the types of solution offered and accepted.

This symbiotic relationship between science and culture operated at a number of levels. At its most direct religious rites, through their concern with the direction of the *quiblah* and the timing of the rising of the sun and moon, created a pragmatic interest in geodesy and astronomy. At another level the belief that science – as we would use the term now – reveals only one aspect of a multidimensional reality tempered the science itself. Scientists gave answers which were not posed in the unilateral manner of analytical and quantitive science, but were rather an art form of qualities and symbols.

To imagine such a 'science' is not easy for those steeped in contemporary ways of seeing science. Yet Nasr is able to give some fuel for its distinctiveness through its technology. The science emerging from an Islamic cosmology emphasising harmony, equilibrium and balance, led Muslims to create technologies that utilised natural forces through the maximum use of human skills and with the minimum disturbance of the natural environment. Technical change in and for itself was frowned upon. Like the Chinese who had gunpowder but never made guns, Muslim technology harmonised with the environment. The technical artifacts that were manufactured, especially those for liturgical use, had the beauty that came from utility.

Yet this and future evaluations from other Muslim perspectives by historians will only show that a distinct Islamic science did have a fitful existence in the past. While this certainly demonstrates the possibility of a rebirth, this will not be a return to the past, but rather a step into the future. A new Islamic science will have to be a science for the late twentieth century, and will bear the marks of its period. But this will require an appreciation of principles that should guide the foundations of an Islamic science. Ziauddin Sardar[19] has put forward a set of values that could do this. Sardar believes that there are ten values at the core of Islamic thought: four standing alone, namely *tawheed* (unity), *khilafah* (trusteeship), *ibadah* (worship) and *ilm* (knowledge), plus three opposing pairs. These pairs are *halal* (praiseworthy) v. *haram* (blameworthy), *adl* (social justice) v. *zulm* (tyranny), and *istislah* (public interest) v. *dhiya* (waste).

In attempting to reconstruct such a science these values could be put against technical and research programmes to establish whether such programmes fall within the ambit of Islamic science. Questions can be asked as to whether the results of a particular programme: will lead to a higher measure of social justice or reinforce tyranny; will respect or not

the position of trusteeship of man with respect to the world of nature; will promote public interest rather than waste.

Such questions would clearly have put certain high technology projects outside of the pale. For example, the Kufra oasis development project in Libya would have never started. The idea was to turn the desert green by the importation of skilled techniques and large quantities of fertiliser plus the use of water from an immense underground natural reservoir. Hundreds of acres of alfalfa was to be grown and this was to be the basis of lamb-breeding for meat. This project breaks the values of both *itislah* and *khilafah* as it increases reliance on Western 'experts' at the expense of the subsistence farmers and depends upon a water supply – connate water – which has been retained in the rocks since their formation and is not being replenished.

Similarly, many of the town planning schemes implemented in the Middle East pay no attention to Islamic *mores*. The extended family is inevitably destroyed as Western-style urbanisation takes its toll with its ubiquitous and alienating tower blocks and expressways. The sense of community is atomised as improved communications lead to an insistence on mobility and the production of the flat-dwelling, capital-hopping 'gypsies' of the twentieth century.

In industry the embrace of Taylorite scientific management with its destruction of the skills of craft through the ceaseless fission of the work process goes against *tawheed* and *ilm*. The whole architecture, where man becomes dwarfed by his own creations, replaces the worship of nature's wonders with a concrete and steel materialism.

All of these and many others subvert Islamic values. But these examples are all negative ones in that they show where Western science has failed the Muslim world. Obviously the positive side of a new Islamic science is less easy to illustrate, for it requires foreknowledge of something that does not as yet exist. Certainly it is not possible even to imagine the new paradigms that would emerge to frame this science. Nevertheless some pointers to its concerns can be given. These would all show a closer match to Sardar's Islamic values than current scientific concerns which sadly neglect fundamental areas of interest to Muslims through the dictates of the big high technology science fashion in the West.

These areas would include, among others, the following. In agriculture, the enhancement of subsistence farming in all its aspects from farm machinery to crop development, in desert environments that used this environment rather than attempted to change it. In pharmacology, a balanced concern that dealt with the effect of all drugs on human physiology rather than the one-sided over-concern with those traditional ones coming from outside Western culture. In animal husbandry, work on the domesticated animals of the Muslim world, along with serious work on

the origins of dietary taboos. In energy technology, an emphasis on small-scale renewable energy sources such as solar energy, ocean thermal energy conversion (OTEC), etc., rather than fossil fuels and nuclear power. The physics of wind-blown sand and desert dunes rather than the n plus 1 elementary particle. In chemistry, work on the causes of soil infertility in low precipitation environments rather than on synthetic chocolate or artificial colouring agents.

Among the softer sciences, architecture and town planning could attempt to use natural materials to create an urban environment that did not produce the alienation and atomisation of the inner city 'no go' areas of the West, but instead maintained and strengthened it by the feeling of community and the value of the individual rather than the anomie of mass culture.

The mix of science undertaken within any given society is a reflection of that society's concerns and indicates the path it is taking. Science in the Muslim world today reflects the values and concerns of Western society; and it is turning Muslim socieies into poor replicas of Western ones. A re-orientated research programme that reflected the concerns of Muslim society would eventually lead, if Kuhn is right, to the inevitable production of an Islamic scientific paradigm. Only by counterposing an alternative science and technology will it be possible to halt and reverse the impact Western science's hidden values are having upon *dar al islam*. The way is now open.[20]

References

1 C.P. Cavafy, *Collected Poems*, Chatto and Windus, London, 1975.

2 S. Hamarneh, 'An Editorial: Arabic Science and Technology', *Journal for the History of Arabic Science*', vol. 1, pp. 3–7, 1977.

3 See for example: B. Lewis, *The Emergence of Modern Turkey*, 2nd edition, Oxford University Press, London, 1968.

4 H. Butterfield, *The Whig Interpretation of History*, Penguin, Harmondsworth, 1973, pp. 17–18.

5 E.H. Carr, *What is History?*, Penguin, Harmondsworth, 1964, p. 9.

6 R.G. Collingwood, *The Idea of History*, Oxford University Press, London, 1961. See also his *An Autobiography*, Oxford University Press, London, 1939, and *The Idea of Nature*, Oxford University Press, London, 1945. Despite Collingwood's interest in science, it should be noted that his analysis contains only inchoate traces of what is outlined here.

7 J.D. Bernal, *The Social Function of Science*, Routledge, and Kegan Paul, London, 1939, and *Science in History*, Watts, London, 1954.

8 G. Sarton, *An Introduction to the History of Science*, 5 vols., Williams and Wilkins, Baltimore, 1927, p. 48.

9 K.R. Popper, *Conjectures and Refutations*, Routledge and Kegan Paul, London, 1963. See also his *Objective Knowledge*, Oxford University Press, London, 1972.

10 T.S. Kuhn, *The Structure of Scientific Revolutions*, 2nd edition, University of Chicago Press, Chicago, 1970.
11 B. Hessen, 'The Social and Economic Roots of Newton's "Principia"' in *Science at the Crossroads*, Kniga, London, 1931.
12 See for example: I. Lakatos and A. Musgrave (eds.), *Criticism and the Growth of Knowledge*, Cambridge University Press, London, 1970.
13 A. Feyerabend, *Against Method*, New Left Books, London, 1975, and his *Science in a Free Society*, New Left Books, London, 1978.
14 H. Rose and S. Rose (eds.), *Ideology of/in the Natural Sciences*, 2 vols; vol 1, *The Radicalisation of Science*; vol. 2, *The Political Economy of Science*, Macmillan, London, 1976.
15 Z.A. Medvedev, *The Rise and Fall of T.D. Lysenko*, Doubleday, Anchor, New York, 1971.
16 J. Needham, *Science and Civilisation in China*, numerous ongoing vols, Cambridge University Press, London, 1954–
17 The ideas behind this analogy owe much to A. Lycett, 'The Ageless Magnificence of Islamic Calligraphy', *Azure* 2, pp. 30–33.
18 S.H. Nasr, *Islamic Science: An Illustrated Study*, World of Islam Festival Publishing Company, London, 1976.
19 Z. Sardar, 'Why Islam Needs Islamic Science', *New Scientist*, vol. 94, pp. 25–8, 1982.
20 The origins of this chapter are to be found in G. Ford, 'A Framework for a New View of Islamic Science', *Adiyat Halab*. vols. 4/5, pp. 68–74, 1978/9.

PART TWO
Science and values

3 Science and values J. R. RAVETZ

Our discussion of science and values must examine two critical problems. The first of these is approached from the standpoint of the Muslim world. This is, whether after a successful process of 'development' there will be a world that can be properly described as Muslim at all. As Sadr demonstrates so convincingly, it is not hostile to science; indeed the search for knowledge is a sacred endeavour for Muslims. Similarly, the relief of material poverty is a duty for all Muslims. But a rapid growth in material goods and systems, imported from an alien culture to one whose strength still lies largely in religious tradition, could have devastating social and cultural effects. This challenge to the Muslim world is not new; but even as Muslim thinkers become better equipped to cope with it, its intensity and its dangers increase daily.

The other critical problem has to do with that total system of science and technology which so largely defines the civilisation of the Occident. In recent years we have become aware of some paradoxical properties it possesses. In many respects, it has been a liberation for mankind, yet, as can be seen from the Islamic perspective, it can also be a threat, cultural as well as material. After some centuries of simple optimism, scientists had the experience of (in Oppenheimer's words) 'tasting sin', and doubtless finding it sweet. It is tempting to distinguish between the *essence* of science from which can flow only truth and goodness, and some *accidents* with regrettable but remediable evils. Many of us are not so sure that this demarcation is straightforward. There may be a need for moral judgements on science; not to lead to externally imposed prohibition, but perhaps to a sense of wonder and modesty among scientists themselves. Such judgements will need to come from fields of discourse and experience where values are accepted as real, and form the objects of reflection and discourse.

The two problems are of course related. A science-based technology which relies on a 'hidden hand' for its proper shaping and direction is very liable to harm systems of human practice and belief which rest on another foundation. And scientists who cannot imagine how evil could come out of science are unlikely to be the most sensitive leaders and guides for the endeavour.

It is in this spirit that this critical essay is written – I appreciate that both the Muslim world and the West have a common commitment to the application of science to the highest ends of humanity.

The basic issue

Permit me to begin this essay with a paradox which is deeply buried in the ideology of Occidental science. To see one part of this paradox we consider some very traditional oppositions that have become commonplace among those who live in this world of science. I can make two columns, one I describe as facts, the other as values. And then in those two columns I could have, respectively, objective, subjective; hard, soft; out there and real, in here and illusory. This then is the world of hard scientific facts, free-of contamination by values: *That* is the world of 'religion'. This distinction has been argued and elaborated by some of the most influential of philosophers who have spoken on science in our tradition. Certainly it is clear and fundamental in David Hume, but it can also be found quite explicitly in such philosophers as Descartes and Galileo and then it has become dominant in the modern twentieth-century philosophies of positivism, and certainly it is the ruling assumption of education in science and technology. Any student who goes through such a course learns a great mass of supposedly hard objective facts and is certainly never exposed to the *soft*, subjective problems of values, which might arise when these facts are put to use. So there then we have one part of what we shall see as a paradox, namely the distinction between objective, scientific facts and subjective human values.

Yet we know that values do exist in some sense or other because it would be impossible to have a world of human practice without them. And then, much to one's astonishment perhaps, one finds our prominent philosophers and propagandists for science saying that science, in virtue of its special properties, is actually the basis of genuine human values. Perhaps the greatest and most clear example of this claim comes through what we might call the Evolutionary movement. This was not simply a set of profound and ingenious hypotheses advanced by Charles Darwin, but rather a programme for the sciences of life and behaviour, in which all phenomena were to be explained in terms of an evolution in which there were no such things as higher purposes or plans. And this evolutionary movement, which had explicitly anti-clerical bias was designed to replace traditional teachings by the religious on all such topics. It tends to be forgotten how sharp was the battle in various Occidental countries between that movement and the orthodox. Now that 'creationism' is rearing its ugly head, mainly in the United States but also elsewhere, the scientists are rather shocked, saying that those people are bringing non-scientific considerations into scientific questions. But in fact this had already been done by the Evolutionary movement, both in its explicit propaganda directed against traditional teachings on matters of social and moral concern, and also now that scholars have examined these doctrines more critically they can

see that such concepts as 'fitness' and 'progress' are themselves laden with values.

Another example of how a supposedly value-free state does become the foundation of value is in the ideology of pure research which not many years ago was articulated very eloquently by the French biologist Monod. For him the ethic of Truth is an absolute value which must not be compromised and which provides the highest calling for those who are so fortunate as to cultivate it. Now truth here means objective truth, scientific truth and yet by some alchemy of logic, this value-free truth becomes the foundation of human values.

And so we have this paradox, that the ideologists of Occidental science have been able over some centuries now to claim the benefits of the human significance of their subject by making it the foundation of values, while at the same time avoiding the costs and responsibilities of that significance by arguing or pretending that their subject has no commitments within itself to values. This is a formula which might be called 'having your cake and eating it too' or alternately 'exercising power without responsibility' even if in an indirect way. But I hope that I have put across the thought that there is a deep paradox, or in fact inconsistency or self-delusion, in the traditional propaganda for science, which claims that it is a valuable activity, a valuable sort of knowledge, precisely because it denies the presence of values within its realm. The resolution of this paradox, it seems to me, is essential if after a successful process of science development we still want a Muslim world that is recognisable in terms of Qur'ānic values.

How values influence scientific knowledge

How do values influence scientific knowledge? This influence must be far from obvious since it seems to have remained hidden from philosophers of science, propagandists for science and researchers and students for all these many years. So really I am arguing something which is against the commonsense of our whole culture, both outside and inside science. Let us look at those on the inside first. Students are given a collection of highly technical exercises on which they must master technique. They are also given explanations of the processes which are handled in these exercises which they must try to understand as best they can. Certainly in all of these it is a question of objective fact; there are no values, indeed there is no uncertainty. In scientific education, every question has only one right answer among all the many wrong answers. When we come to scientific researchers, we might here use the idea developed by Kuhn on normal science, where as he said, all scientists most of the time, and most scientists all of their time, are devoted to solving puzzles within a paradigm. There they simply do not consider basic questions of what their

terms mean, still less do they consider questions of the importance of the various dimensions of value of the work which they are doing.

However, when we look at the processes of decisions in science, we find values being invoked all the time, even if they are frequently suppressed. Perhaps the clearest case of the application of values and their subsequent suppression is in teaching. The syllabus is presented to students as if there is no question about the choice of topics any more than there is a question about the correctness of answers. Yet any teacher knows that scientific syllabuses are always the result of acts of interpretation, and even more of selection. If you wish to teach a subject, you must always throw away more than you can preserve; and your principles of selection are determined partly by considerations of feasibility but even more strongly by considerations of value. Similarly, when scientists are faced with choosing between problems, perhaps not so much at the puzzle-solving level within paradigms, but certainly when it is a case of the allocation of resources to large-scale problems and fields, then values come in. The distinguished statesman of science, Alwin Weinberg[1], some years ago wrote his pioneering paper on the criteria of scientific choice, where he indicated simply the dimensions of value that are involved – those internal to the field, those related to neighbouring fields, and finally those related to external and social values.

Thus as soon as we come away from accomplished facts and look at the processes of decision and choice, the presence of values is undeniable. However, some might wish to argue that even if our knowledge is selected by values, what scientists find is essentially value-free. That is one of those topics that one might debate at great length but I will give an example to show how the very determination of an experiment will depend implicitly, sometimes explicitly, on the values which are being brought to bear in the framing of the problem. Let us take a very simple example of the design of statistical tests. If we wish to test a correlation between two factors or variables, it is not simply a case of getting a yes-or-no answer – yes they do correlate or no they don't – rather we will get a certain number indicating the degree of correlation but that will always be modified by an estimate of the significance of the correlation, roughly speaking the odds against that particular correlation being purely chance. When we are designing a statistical test, we must decide in advance on what significance level we wish to work to. If we wish to have a higher significance level, which is then a more rigorous test, we must have a larger size of sample, a more lengthy and laborious and careful testing procedure. In many fields testing is done to 95 per cent significance, in other words a one in twenty chance. In other fields it must be done to 99 per cent significance, that is 100 to 1 odds against a result being spurious. The choice of significance level determines the design of the experiment; and then we

say, from what derives this choice of significance level? And that, the source of the selection of significance level, is the value assigned to the different sorts of errors that might arise in the taking of the test. There is no space here to go into full details, but you can see that if you are testing for something very, very dangerous then you want a higher significance level to be sure that you have missed nothing bad. If you are doing something which is quite straightforward, then it is all right to have a lower significance level and save money on the test. And so deep in the heart of our quantitative techniques, we have value loadings put on, which derive from the intended functions of a result and which then shape the hard experimental quantitative work that is done.

Finally, one might argue that although the influence of values on the *contents* of our knowledge can be debated, certainly the influence of values on the *limits* of our knowledge is patent once you think of it. If I may put it paradoxically, whereas it might be difficult to argue for what has been called 'the social construction of knowledge', it is easy to argue quite convincingly for what I have called 'the social construction of ignorance'. Ignorance is socially constructed very easily, very commonly, in terms of the values and (I should also add) political forces which determine what is desirable to know and also what is fit to print.

Values and technology

On this issue it may be easier to establish my case, since there has been much popular debate about alternatives within technological development. However, it is useful to review the illusions about the value-free character of technology which have been dominant until so recently. These are two. One is that there is a 'market' which automatically determines what will happen, and also automatically determines what will be the best thing to happen. And so on that particular simplified model people will try out innovations on the market, and then the market, acting rather like the 'hidden hand' of Adam Smith's political economy, will see that all is for the best in the best of all possible worlds. The other illusion is what has been called 'the technological imperative' consisting in the faith that everything which is *possible* is *obligatory*. This is found principally among inventors and developers who naturally wish to see their own pet devices put into practice, and so in times when all the fashion is for novelty, growth and development, the technological imperative becomes very plausible indeed, at least for those who stand to profit by innovation.

Now these illusions are very strong indeed and if we look back over history, it must be admitted that many of the inventions which have contributed eventually to the prosperity, safety and comfort of people within the Occidental system have been advanced on the basis of those

illusions, or perhaps more simply on the basis of the values which underlie them. Certainly the illusion of the market is underlain by greed, and the illusion of the technological imperative is underlain by pride.

It is hard to imagine the peculiar technology of the Occident developing as it has in the absence of those base emotions which drove us forward, innovating as no other civilisation has ever done, and in the process conquering other cultures and much of the natural world as well. However, we must look critically at that technology, while acknowledging its benefits.

Both of the illusions about the value-free character of technology are violated all the time, even in extreme free-enterprise societies like the United States, for society finds it necessary to disrupt free markets in all sorts of ways. Let us take cigarettes, where there is a mild warning from the health authorities to people who wish to smoke, but at the same time an enormous subsidy from the federal tax-payers to those who grow tobacco. When it comes to alcohol, the attitude of society is ambiguous in ways we all know, America having even gone through one 'noble experiment' in its attempt at total prohibition. Passing on to other narcotics, commonly called drugs, such as marijuana and opium derivatives, we find a very different attitude of society, namely one of fear and attempted prohibition; and yet at the same time, a large and important section of the economy, both American and world-wide, depends on the supply of that particular market. And so we can say, not every market in consumers' goods is governed simply by utility to the best advantage of all.

As to technological imperatives, we have now seen them violated again, and again, even in the United States when the possibilities of more extensive exploration and colonisation of outer space have been rejected by the American government once the great conquest of the moon was achieved. Perhaps another example of a technological imperative which came unstuck is supersonic air transport, of which the rather pathetic remnants of the fleet of Concordes are only a reminder of how deep could be the illusions of that heroic, optimistic period of the 1950s and 1960s.

The exposure of these illusions in the case of technology is perhaps most important for the less developed countries. It seems to me that the real important message of what has been called 'alternative' or 'appropriate' technology is not that 'small is beautiful' but rather that someone is choosing the technology that is being presented to you. The question is who is choosing and by what values? There will always be a choice, there will always be values: the questions is whose choice, whose values? If the choice and the values are not yours then they will be someone else's. This I think is what we can learn from the experience of recent years and this philosophical point that our technology is determined by our values, as much as, and even more obviously than, our science.

The roots of Occidental science in the realm of values

Having sketched an analytical argument for my thesis of the value-loading of all our knowledge, I would like to go back through history to give us some better perspective on our present situation and future prospects. And for that I review the creation of this characteristically Occidental science which has been distinguished from the varieties of science practised all over the world in other cultures and other times. We can with some precision give a date and place to this peculiarly Occidental science.

It was in seventeenth-century Europe where it was announced by a few prophets who saw a different sort of science being possible and necessary. Then over the next few decades it was received by an audience and fairly quickly became commonsense. Scholars have called this 'the Scientific Revolution', but they have seen that the revolution was not so much *within* science as *about* science. In almost all technical fields progress in the seventeenth century followed quite continuously from that of the sixteenth century and the science of the European Renaissance was picking up from where the science of the Islamic cultures had left off at various times and places in previous centuries. So with the exception perhaps of mechanics and of cosmology, there was a strong continuity within science in this seventeenth century of 'revolution'. The revolution then was about science, it was about the functions, the methods and the objects of knowledge of the natural world.

Briefly, this new science was announced and born in a polemical text on those issues. It was not a simple opposition of old to new, in fact there was a three-sided debate, wherein we may first distinguish the Aristotelian scholars, university-based, relying on books for their sources whose picture of the world was what we may call organic. But there was also what we may call a magical tradition, located among independent practitioners, alchemists and such people, whose source was a totally involved manipulation of the natural world and whose world picture can be called enchanted. And then came this new philosophy, which we may call mechanical, operating by observation and experiment and in a world which is one of dead nature, disenchanted and dehumanised. This new philosophy was not a complete and utter break with its predecessors, in particular it retained an ideal of power from the magical tradition and an ideal of disciplined literate operation from the Aristotelian tradition. But in combining these, it brought an entirely new element: the power to which it aspired was secularised. We may say that the power envisaged by the new philosophy was a social possession over dead nature, rather than an individual possession interacting with the cosmos. The new philosophy rejected not merely the book learning of the Aristotelians but also, and in polemic, even more vehemently rejected the involvement of the alchemist and most strongly the illumination of the visionary or mystic. So this

revolution within science was basically in its objects and functions, and the methods of disciplined, socially-organised, analytical research followed from these more basic changes.

We may see the innovations most clearly in the most self-conscious of the prophets of this revolution, such as Francis Bacon. He took the traditional division of the aims and ambitions among mankind and gave it a very fateful modification. Instead of imagining material wealth and noble acts as the ordinary things and then having the state of wisdom or contemplation as the highest goal for humanity, he took the first two as they stood and then said that the greatest ambition is to extend the dominion of mankind over all of nature. And thus was established this idea of power of all men as a social possession over nature. With Bacon also came the aphorism 'knowledge and power meet in one'. Thus power, secular power, material power operating socially, became the dominating value of knowledge in contrast to a personal, intuitive or contemplative value which had hitherto been ruling over all generations in the cultivation of nature. So it is not easy to say which came first in all the causes and factors of that complex event we call the Scientific Revolution. My own belief is that it was a very rapid period of change in a centuries-long process of historical evolution of world-view, or if you wish, of common experience of the world. Quite suddenly, over a period of relatively few generations, it was no longer real to people that there could be a contact, meaningful effective contact with a realm of experience other than that revealed by the eyes and the hands. With this change in the objects of knowledge came a change, a secularisation of the values of knowledge, and following on that came a change in the methods of achieving knowledge. Western Europe, and following it the whole Occidental civilisation, has lived in that world, for better or for worse ever since.

The values that are enhanced by Occidental science

Now let us make it plain how much we all owe to the success of Occidental science. Right from the beginning one sees a commitment to a dignity on a strictly human, secular plane in all men. This comes out like a revolutionary clarion in Descartes *Discourse on Method*, which starts with the claim that of all things, good sense is the most equitably distributed. All men can think equally well, the peasant as well as the noble. Francis Bacon proposed a method whereby he would level men's wits, not really believing in a full democracy of learning, but again seeing that our innate capacity to reason and to learn is common to us all. A similar sentiment is expressed in Galileo. In the eighteenth century, this dignity of the intellect, is extended to a dignity of the person. We find its most eloquent expression in the Declaration of Independence of the United States of America: 'We hold these truths to be self-evident, that all men are created

equal, that they are endowed by their Creator with certain inalienable rights.' Then through the nineteenth century, the process of material improvement of the condition of all, poor as well as rich, has led to an amelioration in the moral and spiritual condition of all classes. We no longer need to hold society together by terror and cruelty, we no longer torture prisoners routinely in order to find out the truth from their lips. We no longer treat women or other races as if they are inferior beings.

And so by the mid-twentieth century, on the basis of this dignity and material improvement, we could think at long last of the possibility of what one recent prophetic author, Norbert Wiener[2] has called 'the human use of human beings'. This would be possible, he saw, through cybernetics, that is automatic machinery. When all of the dirty, disgusting work could be done by mindless machines, people would be freed to cultivate their truly human pursuits. Most important – and here is the great shining commitment or faith of this programme – when we no longer need to subject our fellow human beings to dehumanising conditions of work or life, then we (that is, the literate, affluent ones) will not need to pretend that they are less human than ourselves. And so on the basis of a common recognition of humanity made possible by our material progress we will enter into the truly civilised life.

The values that are threatened by Occidental science

Continuing with Norbert Wiener, one may note that he wrote another book slightly afterwards called *God and Golam Inc.*[3] Here he dealt with the dark side of this secularised socially-possessed power of Occidental science and noted the grave risks that it would be handled irresponsibly. He reminded his readers that the category of sorcery does not require the saying of enchantments; it only requires an irresponsible, irreverent use of power. And it seemed to him given the process even in his own cybernetics, and certainly in nuclear weapons as in many other fields, that the pursuit of knowledge for simple curiosity, without an appreciation of values, without a reverence for nature, would surely lead to an immoral state and to a disaster. This is what we now face. We should not blame Occidental science for this in any simple way – all the evidence shows that scientists and ordinary folk are no worse in our sorts of countries than they are anywhere else, even in the most theocratic of societies. As an example of this I recall a comment made by a colleague of mine on a most beautiful picture in the profound book by Hossein Nasr,[4] depicting a city in the Islamic world set in its habitat, and described in the caption as an example of how harmonious living could be made. Yet the environment of that city in that picture was a desert and it seemed possible to my colleague that the desert was totally man-made, because we know that much of the area of North Africa and the Middle East is indeed a desert

made by man long before we had modern science and its particular vices to contend with. Even under Islam, knowledge could be abused and deserts could be made.

At this point, let me describe the situation of Occidental science in terms of the problem of evil. Although our civilisation has tried to abolish evil, in fact we have only succeeded in pushing it away from our ordinary lives. We have either exported it to others, as in the colonial third world or we have concentrated it somehow into very unstable systems of matter and energy. And so now the apparently benign societies of the Occident depend partly on the misery of the Third World and also partly on luck. This is the luck that our technological system does not go seriously wrong, either in the short run as with nuclear reactors releasing radioactivity, or the long run through some pollution or perhaps greenhouse effect.

To put it another way, we thought that we could humanise humanity by abolishing poverty through material affluence. In that we ignored two fundamental features of society and nature. One, in order that some should be rich, then others most certainly must be poor. They may be divided by gender, by colour, by class or by nation, but the poor must be with us in order that some should be rich. Secondly, our affluence was bought by means of an unstable and artificial intrusion in the world ecological system. And now we must wait for the bill for those costs to be presented, so in that sense our technological civilisation is living on its luck. How long will this hold is anyone's guess.

Where we are now

To put it systematically, the style of Occidental science and technology which suppressed and ignored the question of values which was based in the faith that all problems could be decided 'scientifically', now finds itself enmeshed in even deeper contradictions. Another category produced by Alvin Weinberg, that of 'trans-science', describes the problems that we face. It is impossible to calculate the risks and the environmental impact through the future life of any major technological development. Our science is totally inadequate to such a task, and even if it were better developed would probably not be good enough. And so when we have decided on some major innovation, be it a concentrated unit like a nuclear power station or a diffused technology like the automobile or the micro-chip this has been done not on the basis of science but on the basis of guesses, speculations, commitments, values. Thus just as our ignorance is a social construct, as I said before in connection with knowledge, so our material technology has been similarly a social construct based on values which are usually concealed and most often of a less enlightened kind. As a result we find ourselves in the Occident with a technology which is little understood and even less controlled. New devices and systems come into

being not because they are proved scientifically to be 'good' nor because they are accepted democratically for human benefit but rather because certain institutions devoted to promotion and development want to have them.

Perhaps this is most easily seen in connection with nuclear weapons because, as is now becoming clear, the logic of nuclear warfare contains so many destructive paradoxes that it is impossible to conduct a rational argument leading to a choice between weapons systems, since every such argument involves the possibility of the destruction of civilisation itself. And so nuclear weapons develop, apparently guided by a logic which can only be described as paranoid, in fact governed by the dirtiest sort of power politics among competing institutions, and finally having the only redeeming feature that so much of it is technically corrupted that it probably won't work anyway when it comes to the crunch. And yet nuclear weapons – the major science-based sector of the arms industry which again is the major sector of research and development in all advanced countries – sum up the instability and the tendencies to self-destructive insane logic of so much of our system.

Our Occidental science, then, has given us paradoxes and contradictions all round; and this is the present state of a system of knowing and doing and being based on a certain restricted contact with the world of reality, and whose intellectual faith involved the relegation of the realm of values to another irrelevant and impotent sphere. The triumphs of this Occidental system are all around us but its perils are crowding in upon us at an increasing rate and it is for that reason that I feel the question of the values underlying that system must be brought out for discussion.

References

1 Alvin Weinburg, 'Criteria of Scientific Choice', *Reflections on Big Science*, Pergamon, Oxford, 1967; and Alvin Weinburg, 'Science and trans-science', *Minerva* 10, pp. 209–22, 1972.
2 Norbert Wiener, *Cybernetics*, MIT Press, Cambridge, Massachusetts, 1948.
3 Norbert Wiener, *God & Golem, Inc.*, MIT Press, Cambridge, Massachusetts, 1964.
4 Hossein Nasr, *Islamic Science: An Illustrated Study*, World of Islam Festival Publishing Co, London, 1976.

4 Knowledge without science: science without knowledge? HELGA NOWOTNY

Science as culture

In 1894 Frederick Engels published an article in which he borrows from Ibn Khaldun the following description of the development of the Muslim social system:

> ... Townsmen, growing opulent ..., become lax in the observation of the 'Law'. The Bedouin ... contemplates the wealth with envy and lust. They unite under the direction of a prophet, a Mahdi, to punish the faithless, to re-establish the ceremonial law and true faith, and by way of recompense to appropriate the treasure of the faithless. A hundred years later ... they find themselves at exactly the same point as their predecessors; a new purification is required; a new Mahdi emerges; the game restarts ... These movements are born of economic causes even if they have a religious camouflage. But, even when they succeed, they leave the economic conditions intact.

This he contrasts with what he sees as the essence of Western development:

> By contrast, for the popular risings of the Christian west the religious camouflage is only the banner and mask for an attack on the crumbling social order: in the end, that order is overturned; a new one emerges; there is progress, the world moves on.

This is not the place to retrace the limitations of Engels' interpretation of Ibn Khaldun or the usefulness of applying Ibn Khaldun's analysis to modern events – tasks that have recently been performed in a highly reflexive manner by Ernest Gellner.[1] According to him, of all the great literate world religions, Islam plainly seems to have the greatest political clout, the greatest capacity both for fortifying states or for inspiring political activism and a new self-identification. But our topic is not the role of religion in analysing contemporary or past politics; it is rather an attempt to reach a better understanding of the role of science and technology and their linkage to the core of the social system, including values as to the indispensible constructive glue that binds together the structuring material of which social institutions are made.

It is within this scope of analysis that the passage cited from Engels represents in almost ideal-typical fashion two seemingly different modes of societal development: in Islam, as magisterically exposed by Ibn Khal-

dun's sociology, it is the cyclical process perceived by the participants as one of religious reform and purification, as the succession of a set of finely tuned social balances of destruction and reconstitution. In the West the inevitable law of progress rules, the world moving on with the old social order crumbling and ruins being left behind. Undoubtedly, one of the prime movers behind the whole machinery of progress was and still is science and technology as conceived in the West in its so-called modern form. Occidental science, as J.R. Ravetz has rightly reminded us in Chapter 3, was in its inception not so much a revolution within science, but about science. The lines of continuity with earlier traditions, notably those developed in the Renaissance who in their turn strongly built on Islamic scientific predecessors, were stronger than generally acknowledged. New were the functions ascribed to science, the methods and the objects of knowledge of the natural world.

Any historical and/or comparative analysis rapidly confronts us with the uncomfortable fact that science is neither invariant, nor homogeneous and yet there is undoubtedly a common invariant core of a programme of inquiry, a claim to universalism of knowledge which progresses in its various and diverse manifestations. The Middle Ages had their sciences, although not readily recognisable as such from a modern point of view since law and theology functioned as the systematic expression of the scientific culture which that particular form of society had brought to the fore. To explore this relationship cannot be just a question of vulgar selectivism, of explaining why some societies excelled in some fields which presumably tied in well with their specific economic or military expedients, but rather of exposing the mechanisms in which societies generate specific forms of scientific activity, to what extent they are able to provide institutional frameworks for certain forms of systematic inquiry, recruit and organise their members and sustain the necessary preconditions for the pursuit of critical analysis. Furthermore, it has to be recognised that even within occidental science several historical forms coexist, just as there are shifting core-periphery relations within scientific achievements and their geopolitical location of which developing countries have only become too painfully aware.

Finally, there is the question which specific forms of interlinkage, i.e. of conflict, hegemony or coexistence, is found in any society with regard to science and technology and which constitutes the nature of their relationship to other social institutions. Of these three broad categories of questions – the relation between types of societies and forms of science, different historical sub-forms within science and their geo-political location, and the kinds of interlinkages between science and technology and other social institutions – it is clearly the third which is of greatest interest to our present concerns. Presuming that knowledge represents all forms

of systematic inquiry, of which scientific knowledge is one part, how is this body of assumptions and methods, of strategies and in-built corrective devices, of systematised form and content linked to science as a social institution which is bound to vary with the specific historical conditions in which it finds itself.

Secularisation and the success of science

The history of the relationship between modern science in the West and societal development can be captured basically as a continued process of secularisation which ended up to be so successful that at present nothing seems left to which it could still be applied. Secularisation denotes the slow but seemingly inevitable erosion of a world view based on religious assumptions and its concomitant transformation into one shaped by a scientific outlook. While modern science started, if not under the direct tutelage of the Church, nevertheless under its all embracing influence, it soon became clear that it had embarked upon a course of collision beyond return. Retrospectively all the fierce battles which have been fought, culminating finally in the nineteenth century, appear to have been rear-guard actions on the part of the Christian religious forces; with an inevitable victory of luminous science under the banner of enlightenment programmed from the beginning. Yet it would be utterly naive to attribute what has actually happened solely to the power of ideas, to the scientific method or the strategy of science. Rather, it was the concurrent changes in the economic and social conditions which enabled science to occupy, maintain and expand its place in society in an unprecedented process of inner colonialisation. The decline of superstition, for instance, occurred before the new ideas of scientific progress could reach the population at large and had more to do with an alteration in economic circumstances which provided alternative economic mechanism to ward off the dangers of an unpredictable world surrounding those who had no means of control over the events governing their lives than with science's convincing influence.[2]

The rise of education undoubtedly was another powerful contributing factor, as was the uneven and relative amelioriation of life circumstances. The belief in progress, conceptualised for the first time in the eighteenth century as an unending linear progression into an ever better future, could draw on scientific and technological achievements which came to their full bloom in the second half of the nineteenth century. In this conglomerate of contributing factors and irrespective of the actual weight attributed to the different strands of development, science as an institution could claim to be the prime benefactor for one part of humanity. It was science which effectively monopolised the belief in human betterment, in rationality as the sole and dominant value guiding the knowledge search-

ing process, in the mandate to rationalise successively all other social institutions and to make them subscribe to the programme of modernisation, based once more upon a set of scientific and technical prescriptions. This programme of inner colonialisation was all the more successful when science and technology became productive forces in their own right, providing a leverage for world penetration on an unrivalled scale. Today, as Mulkay remarks, 'there appear now to be no major areas of social life which are uncolonised by science and no significant resources for growth which are as yet untapped.[3] The scientification of all areas of social life in the West has become a pervasive feature to which non-scientific knowledge has succumbed as well.

Yet the very success and its totality make science and technology also peculiarly vulnerable to criticism. Joseph de Maistre once observed that superstition constitutes the outer bulwark of religion. What he meant was that a two-layered system of defence is better than a one-layered. If the other bulwark goes, the inner walls are all the harder to defend, and faith without its social protective belts is an extremely fragile construct of ideas and beliefs, unproven and unprovable, because it rests on transcendental assumptions. But de Maistre's dictum can also be applied to science. Don't destroy folk science, it could read, the joy of tinkering, the bricolage, the folk wisdom embedded in common sense which has survived millennia of coping with everyday life under difficult and ever changing conditions. Yet science has done precisely that, it has evolved more and more in one dominant form: big science and technology with all its costly apparatus, its megalomaniac dimensions, its ruthless expansive course which finds its corresponding cultural expression in the one dominant form of high science. The amateur societies which were still prevalent in the last century have long since vanished, the appropriation of everyday knowledge has proceeded at increasing speed, the lay world has been irreparably separated from the scientific world. Against our historical awareness of contrasted differences and the shades of variation, at present only one form of science and technology seems to have emerged from this historical course: big science and technology, with its incomparable potential for military destruction and world-wide pollution, the capitalising of science as a productive force, subject to the drive for profit and exploiting its power to control.

It is this type of science which is threatening to become the dominant one which has come increasingly under attack in the West. The citadel of scientific faith is under siege and while the assaulting forces may be quite weak compared to the strength of the scientific and technological armoury at the disposal of their opponents, the crisis is nevertheless real. Since the West has no developed mechanisms at its disposal for reform and purification, Engels may prove right with his prediction: in the end that order

is overturned, a new one emerges, there is progress, the world moves on. But what progress and on whose terms remains to be seen.

Crisis and critics

Criticism of science in the West is not a new theme.[4] The various strands reflect different philosophical traditions and, perhaps more important, different struggles between groups that have been moving upward or downward in the course of history, with science and technology helping the one to ascend and destroying the other. Basically, there have been two major traditions of criticism, one defensive, the other offensive. The defensive one has a venerable ancestry, starting with the old humanistic critique of science. It comes from the long faded world of the humanists who had to cede their place to the newly emerging order of industrialisation. This bygone world had more mystics and poets on its side, more warning prophets who feared that the soul would suffer than those, who actually shaped the world in blissful ignorance of the consequences of their action would know or care to know. Pitted against the new mode of acquiring knowledge and putting it to use, which declared itself to be value-free and without morality, the humanistic critique had to attack both the newly claimed monopoly of science to a higher form of knowledge, and the claim to be the only true guardian of truth and rationality. The deliberate image in which science represented itself so well was one of being above values but also incorporating them, beyond human strife and conflict, able to pursue knowledge without the strictures of religion or the shackles of politics.

Today, with the benefit of hindsight, the aggressive defensiveness of these original claims must be seen in the proper historical context. At the time when the claims of offering a new world-view were formulated, they were impossible to substantiate. At the time when the scientific world-view triumphed and started to become widely accepted, science in reality could not claim to offer anything amounting only to the slightest guidance on how people could or should lead their lives and how to conduct their affairs. There is a grave distortion but a fascinating interplay between the claims put forth in the name of science, an illusory trapping which turned out to be so successful that image was taken to be reality, while reality came more and more to resemble its imagery.

Criticisms against science which have their roots in the humanistic tradition, till our day, can be interpreted as constituting essentially a battle between different world-views which gained social prominence whenever they were espoused by a group threatened with moving downward in its social standing and/or in its economic and political power. The deeper irony of this struggle however is that the older monopoly holders of a world-view have lost out – notably religion – while science

has stepped into the void created by the securalisation process. Science however, while publicly claiming to offer a world-view, a rational way of seeing, explaining and handling the natural and the social world, can do no such thing. It cannot offer directions for human conduct, nor construct the kind of symbolic meanings which are an essential and indispensable part of human communication, both among humans and between humans and the natural world of animate and inanimate things surrounding them. While claiming to offer a world view, the constructions of the image of science meet a deeply engrained yearning for a coherent scheme to understand the world, for guidance and orientation, for mental security and consistency in an otherwise complex and incomprehensible world. Yet, when we examine more closely the programme of inquiry of what courts as scientific knowledge, the method that has proved to be immensely successful is an extremely narrow one and getting even narrower with scientific developments moving on to a mature stage.

Thus, the humanists and their present-day successors were right in sensing that science is devoid of morals but wrong in believing that science could actually sustain this as a world-view. They overestimated the monopoly claims made by science in its ability to offer a world-view, while in reality these claims were made only in guise of the colonial expansion of science as a social institution. But they also under-estimated the real strength of the scientific programme which lies precisely in separating, in framing and cutting in devising strategies which would allow to narrow the conditions under which nature could be interrogated. In a certain sense, humanistic criticism has been blinded by its own attachments to values: by attacking the newly proclaimed (and ever since reiterated) alleged value-freeness of science, which in the eyes of the humanistic critics came to stand for much of the debasing soullessness accompanying the industrialisation process, it became a victim of the mere rhetoric of science. Humanistic criticism does not see that value absenteeism is impossible in any human and social enterprise and did not direct its attention to those institutional forces which shaped, guided and increasingly directed both the production of scientific knowledge and its utilisation. It was left to the other major strand of criticism to focus on this target, but once more a price had to be paid for leaving out other dimensions.

The second major strand of criticism is an offensive one. It is not so much a criticism of science, however, but of the uses to which science and technology are put. In its more extreme manifestations, it believes that science is unalterable and unique, above the social forces which gave rise to it, and thus an extremely powerful tool to bring about a radically altered society. The most expressive articulation of this form of criticism occurred in the 1920s and '30s, with antecedents reaching backwards to

the hopes of the labour movement attached to science and technology, while its degenerate technocratic spokesmen today continue to assert that only further science-based solutions will help to solve problems partly created by science.

It was in the time between the two World Wars with so much of the old encrusting order breaking up and intellectually fertile ideas struggling against old social and political institutions, when the banner of science became the rallying point for virtually every social movement. Criticisms were not directed against science *per se*, but rather opinions would sharply differ as to how science and technology would be used and utilised under the different political systems, under the various brands of new social-economic orders which were to be constructed. The belief in science as a means for the construction of a new political and social order was perhaps never before and never again as strong as at the time: in a vigorously industralising world, when the major push towards rationalisation in production and the concomitant shift towards mass production and mass consumption reached Europe with its political forces vigorously opposed to each other, criticism of science became a battle about the social and economic potential of science and technology: for whom, by whom and for what ultimate political goals it would be used. For the towering figures of the old left, especially in Britain, it was beyond doubt that science was on the side of progress, while fascism went on to develop its brand of a technocratic harnessing of science and technology for serving the ideological and actual atrocities of the regime.

Once more science had been interpreted as though it could offer a world-view: 'the scientific world-view'. Science was seen as being infused with whatever projections, hopes and dreams, were associated with the new political order. By a curious irony of history, the alleged value-free science became for a short time the all-embracing container of values associated with divergent views of political and economic progress. The Second World War, which was to sweep over Europe not long afterwards, was the sad proof of one possible utilisation of science and technology and the fervent scientism of the 1930s in its different political guises would never recover from the loss of credibility it underwent as a result.

Today, we have become both wiser and sadder. We had to realise that it is impossible to separate science and technology from its applications, its use and its manifest cases of abuse. This has been the lesson driven home first by the bombs on Hiroshima and Nagasaki and ever since by the seemingly permanent series of crises, from the unknown dimensions of new risks to the environmental crisis, from the increasing stress in our work life to the imminent spectre of domination through science and technology. What we had to learn was also that science and technology

cannot be separated from the social forces that are inherent in them. We have to recognise, although it is conceptually very difficult, that the present political and social order expresses itself in the way how science is done, how knowledge and what kind is produced, how and for whom it is used. And it matters little – which drives home the collective powerlessness of present-day forms of criticism – what we seek to accuse most: the profit motive, the military threat or the iron arm of discipline which increasingly extends into our individual and collective lives, from an all-encompassing information system to the control exerted via the scarcity of work places.

Yet the present-day strand of criticism contains both new elements and offers new perspectives. For the first time, the institutional and cognitive boundaries which have been erected to separate the scientific world from that of lay people, of scientific knowledge from lay knowledge, are being crossed. I am referring to new forms of alliances between critics inside science and social movements, notably the anti-nuclear and the ecological, outside. The veil of the public imagery of science is becoming thinner and the de-mystification of science, together with its general loss of legitimation and credibility of its experts, proceeds. Science is no longer seen as value-free, nor as embracing the values it had publicly professed time and again; the basket of plentitude, the hollow phrase of 'welfare for all' are confronted with the harsh realities of an unequal distribution of risks and benefits associated with its results. The question of values takes on a new Gestalt in the political battles which have surrounded science and technology in the last few years, namely: which values, and whose values: economic growth at all cost or quality of life; the values of an extended technocracy and a scientised bureaucracy; the values of a professionalised class of experts or of those who are being treated as objects?

Thus the merger of the two main strands of criticism in its present form provides a new platform in the old history of criticism. But it also raises new questions; the most fascinating, value-laden, and uncertain one being: is an alternative science possible?

Science without knowledge

Regardless of what the critics say, however, science and technology move on. At the frontiers of science the form of organisation and management of scientific work has reached a high degree of complexity characterised by an over-spill of organising principles from the institutional level of setting up and implementing research programmes where they have been developed into the cognitive realm properly speaking. In some fields, like molecular biology, the streamlining of the guiding organising principles has been very effective, resulting in a kind of structural convergence with the result that life itself is becoming a productive force, ready to produce

according to the programme set up in following nature's own reproductive processes.[5] As a new resource the concept of information has joined the more familiar ones of matter and energy.

The success of using this resource, together with an entirely new range of technical possibilities, carries with it an interesting shift in the way that cognitive objects are conceptualised and the functions of scientific inquiry are determined. It is my hypothesis that we are currently witnessing a shift in the light of the new technological possibilities away from the old category of knowledge, with its dear, but by now somewhat old-fashioned, connotations of including the totality of human endeavours of systematic inquiry.[6] It is gradually being superseded by the concept of information, which provides the new technologically accessible and mediated form in which knowledge is to be coded, processed; stored, recalled, reorganised or diffused – all processes allowing for combinatorial restructuring and iteration. Although knowledge, for want of a better term, remains the content of these processes, it is also plainly evident that the technological forms and possibilities, coupled with a vast generation of data and the necessity to process them, cannot but leave their impact on the content of what is processed. The accumulated knowledge of the past is thus taking on new meaning, mediated by the technical operations necessary to render it productive and applicable.

If this hypothesis is correct, two conclusions would seem to follow, delineating two related developments: a new programme of science, which is no longer based upon knowledge, but which conceptualises and operationalises its cognitive objects within a framework based upon information; and the appropriation of the now no longer monopolised category of knowledge through other social groups, thereby investing it also with new meanings and social functions.

This split, and the emergence of a science without knowledge, is not as radical a departure as it may at first appear. Rather, it is the resolute continuation of the ongoing industrialisation of science which is reaching its next stage. With dead nature appropriated, new conceptual territories have to be explored which are amenable to technological exploitation as well. The old Baconian vision of 'knowledge and power meeting in one' is about to be replaced by 'information and power meeting in one'. Knowledge can safely be left behind, if power is to be sustained, if power will be enhanced by information as the more promising organising principles of scientific and technological expansion. Its promise lies in its ubiquity since it can be employed meaningfully on the cognitive level as well as on an institutional level; it has a management component and a highly efficient technological infrastructure to support it; it can be seen to operate within life processes and is itself a principle of social organisation. Knowledge as a guiding category ceases to be scientifically useful; it can

therefore be left behind, an obsolete empty shell from a strictly programmatic scientific point of view.

Yet knowledge is not just a scientific category, as science with its past claims towards the monopoly on it would have us believe. It is also, and perhaps foremost, a category of human existence, of a truly collective human endeavour to make sense of the world around us. Knowledge has therefore kept its high standing in the remains of whatever has been left in a lay universe, in the folk wisdom and cognitive strategies of coping with uncertainty and the social invention of meaning. It is this lost tradition which is coming to the fore again among those who criticise big science for its technological ruthlessness and high science for having destroyed the informal lines of communication and social relations. Various groups of outsiders are raising their voice and claiming their right to what they see as their lost experience, expropriated areas of knowledge, skills and expertise, as the de-based epistemological and practical status of their own rationalities. It is easy to point to internal contradictions in the claims put forth by these various groups, pressing for their share in determining what form knowledge should take and to what uses it should be put. They want to see their subjective knowledge and experience recognised as part of science or whatever they take to be science. The groups I am referring to are mainly the young, women, and all those who are trying in developing countries to find an alternative form of science, meaningful for their existence and its constraints.

In a sociological sense it only becomes possible to speak about an alternative science at the very moment in which official science has started to retreat from occupying the territory of social meaning which it has colonised as part of its expansive strategy. With its programme of expansion shifting elsewhere, with the scientification of everyday life a completed fast, a second layer of knowledge aspiring to an alternative science can again develop in the West. It takes the form of critical science, in itself still linked with official science, yet offering a differentiated form of consciously blending social dimensions into an otherwise quite blind scientific and technological development following only its own logic of expansion. There are the various forms of fringe science – science for the people movement, radical science collectives, the women's movement – attempting, although partial in their concerns, to develop their own version of what science and knowledge mean to them.

But what participants in this struggle for knowledge in an alternative science see as cause, notably as science and technology having become unresponsive to their subjectively felt needs and being accountable for the unleashed destructive potential, can be reversed from a macro-oriented perspective. The question then becomes what it is in science and technology which render it increasingly incompatible with more than a very few

and highly specified forms of societal life. We have furthermore to ask what science and technology, if they are to pursue their expansive programme, require as further social preconditions for their expansion, e.g. which forms of new division of labour and thought, what degree of further rationalisation of everyday life, including its cognitive and ideological equipment, will be deemed necessary to render the organisation of the process of production and the utilisation of the products of further scientific expansion successful. It is at this stage that we must also ask which conflicts – both within industrialised societies and, in the vast area of potential nuclear destruction, among societies – are to be risked: for what price and for what gains.

Epilogue

Islam, if I perceive this correctly, has preserved an intact concept of knowledge, embedded into its religious and social organisation, while the former institutional system of Islamic science has become ossified and finally ceased to exist at all. The challenge it faces now is how to build new institutions of science which are at the same time concordant with its traditional concept of knowledge and can face the challenges coming from the outside. For what started as Occidental science in the seventeenth century has long since become a world-wide phenomenon leaving no part of the world untouched under its Western-dominated guise. For Islam, the problem is therefore traditional knowledge in search of its own, up-dated and appropriate science. In the West the situation is somewhat different. Official science is about to shed knowledge, since its own technological progress can better do without it. It feels so strong and immune that it can relinquish the century-old claim to hold the monopoly of scientific rationality as being the sole legitimate form of rationality, since it has completed its programme of inner colonialisation. It can drop its protective shield of providing well-being for all, when up to 80 per cent of its R & D budget are directed towards military objectives.[7]

Yet in doing so and in recognising its past image of providing not only intellectual explorations and technological products but a world view, science is leaving a huge void behind it. Such a void – lack of meaning, privatisation of values, existential uncertainty – is socially intolerable. It has to be filled, if forms of social communication, of relating to each other as human beings and of making sense of the world around us, if the very fabric of what constitutes society, as contrasted with one gigantic scientific–industrial–military corporation, are to survive. It is in this void where new developments are currently taking place, where a new social order is taking shape. But it is also a situation in which new patterns of conflict are likely to be born. For the gigantic corporation demands highly specific

forms of social organisation, including a specific system of values, of a cognitive outlook, compatible with its further expansion.

The new critical search for knowledge within an alternative science is fragmented, eclectic and beset by internal contradictions, but unified in its opposition to such demands. Critical movements are at present too weak to build new institutions, yet subversion may prove again one way of resisting incorporation into what they see as one huge, tight system of control over their lives. In the meantime, science without knowledge may itself be moving into another big void – of collective annihilation.

Can knowledge and science meet again? Muslim scientists, with an intact tradition of knowledge, are in an excellent position to answer the question.

References

1 Ernest Gellner, *Muslim Society*, Oxford University Press, 1980; and 'Setting the Seal on the Muslim State', *Times Higher Educational Supplement*, 20 December 1981.

2 Keith Thomas, *Religion and the Decline of Magic*, Scribner, New York, 1971.

3 Michael Mulkay, 'Sociology of Science in the West', *Current Sociology*, 28 3 (1980).

4 Helga Nowotny and Hilary Rose (eds.), *Counter movements in the Sciences*, Yearbook in the Sociology of Sciences, vol. 3, Reidel, Dordrecht, 1979.

5 Edward Yoxen, 'Life as a Productive Force: Capitalising the Science and Technology of Molecular Biology' *in* Les Levidow and Robert Young (eds.), *Science, Technology and the Labour Process*, CSE Books, London, 1981.

6 These ideas have been developed further, but by no means adequately in a German publication: Helga Nowotny, 'Leben im Labor und Draussen', *Soziale Welt*, 2 (1982).

7 Y. Fabian, A. Young *et al.*, 'Patterns of Resources devoted to Research and Experimental Development in the OECD Area, 1963–71', OECD, Paris, 1974.

5 Science and technology in Islam: the underlying value system

M. ALI KETTANI

The growth of science and technology in the West resulted from a revolt against the Christian Church, which in the Middle Ages had held scientifically wrong concepts as absolute divine truths and persecuted mercilessly any who dared to challenge these 'truths'. Thus, in the West, there could be no development of science and technology without the removal of the Church from public life and the complete separation of the temporal from the spiritual. This led to a secular, materialistic Western culture, whether in its socialist or in its capitalist versions.

Claiming that all 'religious' experiences are the same and projecting the Western experience to the Muslim world results from a serious ignorance of historical realities. There can be no similarity between a system of thought that believes in the unity of God, in the harmony between body and spirit and in the inherent goodness of man, who is born free from any sin, and another that believes in the Trinity, Original Sin and redemption in communion. The need for a true Oecumenism and the urge towards it should not lead to a covering up of the different basic beliefs, but on the contrary to a better understanding of these differences.

If, then, the Western experience that led to the modern Western civilisation and its scientific and technological components does not apply to the Muslim world, in what way is Islam different from Christianity? Why did science and technology flourish in the heydays of Muslim supremacy and diminish with its decline, while quite the opposite occurred with Christianity in the West?

Islamic values

Islam is not only a body of religious beliefs. It is a set of ethics and ideals encompassing all aspects of human life, the introduction of which triggered the Islamic civilisation.[1] This civilisation and its contributions to science and technology could not have occurred without the motive force of Islamic values.

The basic word in defining Islam is Unity. First of all comes the Unity of God. God is one, unique, the Creator and Sustainer of all besides Him. After the Unity of God comes the unity of mankind. All human beings are descendants of the same ancestors, Adam and Eve, both of whom were created by God. Differences in colour, language and genealogy are all completely irrelevant. There can be no chosen nation in Islam on the basis of race.

The Islamic concept of unity encompasses also the unity of man's personality. This personality cannot be divided between temporal and spiritual without such a dichotomy creating a high degree of hypocrisy in the society. The temporal and spiritual are only two facets of one single aspect. Man should, in all that he does and says in his private, family or public life, obey the Word of God.

Since all men and women are equal in the sight of God, they bow only to Him and to no one of their own kind. Wealth itself is irrelevant and is important only on the basis of how much good one can do with it. Basically, all wealth belongs to God. A person's property is only in trust in his hands for a defined time.

God has given the earth in trust to mankind. Man should therefore use this trust properly by doing good. This leads to the need for better and more efficient means of managing the trust – that is, developing an appropriate science and technology, which is in itself an act of religious significance.

The basic Islamic ideals are linked with each other in an impeccably well built system in which reason is given its full due. Islam does not request man to believe blindly. He has to convince himself. It is up to the individual to strive and reach the truth by his own means. Thus, knowledge of God is an ideal towards which every Muslim should try to move by seeking the knowledge of His creation: 'in the earth are proofs for those who believe, and within yourself, can't you see?' (The Qurān: 5 20–21). Islam allows that in seeking the truth one may err momentarily in the search. Thus, the great respect for the truth-seeker and the tolerance towards him are a vital part of the Islamic value system.

There is nothing in the Qur'ān or in the teachings of the Prophet Mohammad that contradicts the basic rules of sciences or requests man to believe in anything that has been proved to be scientifically wrong.

God created man for a purpose, which is to worship God; and to do this man has to know Him. Knowledge of God is not based on blind faith: it is based on knowledge of His laws, the laws of the universe.

Man is requested to use his knowledge not only to know God but to serve man as well. In using science for the development of ways and means to controlling the forces of nature, the guidelines given to a Muslim is to seek the good of the community – and indeed the humanity as a whole – and to use good and lawful means to reach this end.

The Golden Age[2]

It was this value system which was behind the phenomenal rise of science and technology during the Golden Age of Islam which began with the era of the Rightly Guided Caliphs – Abu Bakr, Umar, Uthman and Ali – and the *umayyads*. It was in the second part of the eighth century, under the

rule of the first Abbasids that a distinctive Islamic civilisation began to take shape. Caliphs such as Al-Mansour, Al-Rasheed and Al-Mamoun played a great role in encouraging scientific research by all available means and helped create a tradition of scientific scholarship.[3]

The first thing the Muslims did was to learn all that humanity knew before them: they collected books of the Greeks, Persians and Chinese. After this first phase of fifty years, they embarked on a thousand-year era of their own – correcting the observations of the ancients and establishing new fields of science.

In this crucial process, the Muslims avoided two major pitfalls which could have led to their complete assimilation in other cultures. First, they remained within the guidelines of Islamic principles. They concentrated on facts and ignored assumptions; they collected works of medicine, mathematics, astronomy and geography, but eschewed magic and mythology. Second, Muslims insisted on Arabic as the universal language; they translated all known knowledge into Arabic and developed the language as a potent, efficient and effective means of scientific communication between all peoples of the world.

It was during this period that universities and research laboratories flourished in all the major cities of the Muslims world across Asia, Africa and Europe. Hospitals and pharmacies became common even in minor towns, and governments vied with each other to encourage the effort. New technologies emerged, including electricity: the remains of what has been identified as a battery have been unearthed and exhibited in the Museum of Baghdad.

Mathematics

Practically all sectors of modern mathematics are attributable to the efforts of Muslim scientists.[4] This includes its bases and terminology, either taken directly from the Arabic or translated literally from words coined by Muslim specialists. Early Muslims used the letters of the Arabic alphabet as numerals but, by the ninth century, the Western Muslims had invented *al-arqam al-gharibiyah* 1, 2, 3, 4, 5, 6, 7, 8 and 9 – based on a number of angles equal to the weight of each symbol, while the Eastern had devised *al-arqam al-hindiyah* –

١ ٢ ٣ ٤ ٥ ٦ ٧ ٨ ٩

– from ancient sanskrit characters. One of the greatest inventions of Muslim scientists is the zero (*sifr*), written o for the West and · for the East. Combined with the nine basic numerals the zero makes possible simple expressions for numbers having an infinite variety of values.

Muslims continued building their new mathematical model by introducing the decimal system, the ingenious idea of expressing all numbers by

means of ten symbols, each symbol accorded the value of position as well as absolute value. For multiplication (*darb*), they used the lattice method; for division (*kasr*), they used first a trial-and-error method which they quickly replaced by the so-called scratch method and then by long division. To denote a fraction, the Muslims introduced the separation line and expression by decimals (e.g. $\frac{1}{2}$ and 0.5). They also conceived of even, odd and amicable numbers (the sum of the factors of one being equal to those of another).

Algebra (*al-jabr*) is the creation of a genius who came from Khawarizm near the Sea of Aral in Central Asia, Muhammad Ibn Musa Al-Khawarizmi (750–850). From his name was coined the word 'algorithm', used today in numerical analysis, and his reputation has been compared by Western scholars with that of Euclid: 'one of the greatest mathematicians of all time'[5], and a personality of strong scientific genius. He translated several Greek works and, in his own famous book *Hisab Al-Jabr wa Al-Muqabalah*, he defined *jabr* as the transposition of a quantity from one side of an equation to the other and *muqabalah* as the simplification of the resulting expressions. In evolving his algebra, Al-Khawarizmi changed number from its arithmetic character of finite magnitude to an element of relation and infinite possibilities.

Al-Khawarizmi introduced a method, similar to long division, to extract the square root (*jidhr*) of a number. He then established the algebraic system for solving first- and second-degree equations with one unknown; he recognised in this system the existence of two roots for all quadratic equations. He discussed algebraic multiplication and division, offering an algebraic method for finding a triangle's altitude and the two segments of its base when the lengths of its three sides are known. And he was the first to introduce the concept of *mal* (power) for the squared unknown variable.

Al-Khawarizmi was among the first Muslim mathematicians to develop trigonometry by introducing the theories of *jibb* (sine), *tajibb* (cosine), *dhill* (co-tangent) and *tadhill* (tangent). His work includes 100 tables of sine and co-tangent and other trigonometrical values. In a chapter of his book on algebra, Al-Khawarizmi calculated the areas of the triangle, parallelogram and circle, using $3+\frac{1}{7}$ as the approximation for π. He also perfected the geometric representations of qudratic equations having two variables, e.g. the circle, ellipse, parabola and hyperbola (conic sections). He used these in order to solve quadratic equations.

The same scientist developed *hisab al-khata'ayn*, the calculus of two errors, which led him almost to the concept of derivation. Taking the two values x_1 and x_2, close to and on each side of the root of the equation $f(x)=0$, he concluded that the intersection with the x-axis of the chord joining the point $[x_1, f(x_1)]$, $[x_2, f(x_2)]$ gives a better approximation with

the solution

$$x_3 = \frac{x_2\,(x_1) - x_1\,(x_2)}{f(x_1) - f(x_2)}$$

He developed, both algebraically and geometrically, this theorem which has led to the method of 'false positions' used today in numerical analysis.

An Arab from Kufah (in contemporary Iraq), Abu Ŷusuf Ya'qub Ibn Ishaq Al-Kindi (801–70), laid the foundations of modern arithmetic: he wrote an introduction to arithmetic, eight manuscripts on the theory of numbers, and two on measuring proportions and time. Al-Kindi was also the first to develop spherical geometry, which he used in his astronomical studies; he wrote a book on spherics, another on the construction of an azimuth on a sphere, and a third on how to level a sphere.[6]

A Syrian from Harran (now in south-eastern Turkey), Thabit Ibn Qurrah (835–900), was a great critic of Greek mathematics. He translated and commented on the works of Euclid, Archimedes' work on the regular heptagon, seven of Appolonius' eight books on conic sections, and the postulates of Ptolemy and Eutocius (a sixth-century Alexandrian surveyor). Ibn Qurrah wrote on the theory of numbers, including irrational and amicable numbers. For the latter, he developed this theorem: If p, q and r are prime numbers and if they are in the form of $p = (3 \cdot 2^n) - 1$, $q = (3 \cdot 2^{\cdot n-1}) - 1$ and $r = (9 \cdot 2^{n-1}) - 1$, then p, q and r are distinct primes and the expression $2^n r$ is equivalent to a pair of amicable numbers.

Ibn Qurrah also helped establish algebraic geometry in his books on Euclidean premises and propositions and on the propositions and questions arising when two straight lines are cut by a third (in which he tried to prove Euclid's postulate). He generalised the Pythagorean theorem, developed new geometrical propositions, and solved geometrically the cubic equation $x^3 + a^2b = cx^2$ by finding the intersection formed at $x^2 = ay$ (parabola) and $y(c - x) = ab$ (hyperbola). The Syrian specialist almost succeeded in reaching the principle of integration by determining the surfaces and volumes of bodies of all shapes – including ellipsoids – using the theory of limits.

Another scientist from Harran, Muhammad Ibn Jabir Al-Battani (850–929), systematically developed trigonometry (*muthallathat*) and extended it to spherical trigonometry. He computed with a high degree of accuracy the first complete tables of sines, tangents and co-tangents; he introduced the notion of trigonometrical ratios, thus establishing the fundamental trigonometrical relations. He used sines in his own astronomical studies, conscious of their superiority over the Greek chords. Al-Battani developed the relation between sides and triangles for general and right-spherical triangles, applying algebraic operations to trigonometric identities.

A Persian from Afghanistan, Abu-Al-Wafa Muhammad Ibn Muhammad Al-Buzjani, was the greatest mathematician of the tenth century. He complemented Al-Khawarizmi's work (relating algebra to geometry) by solving geometrically equations of high degree viz. $x^4 + cx^3 = h$. He did extensive work on conics, calculating the volumes of bodies generated by the rotation of conic sections around their axes – almost reaching the principle of integration. The Persian's work in trigonometry was outstanding, since it is he who deduced the expressions relating to the sines and cosines of half-angles and full angles as well as the relationships between an angle's secant and cosecant and its tangent and co-tangent.

The work of the physicist Ibn Yunus (d. 1009) was the forerunner to logarithms, proving for the first time that the product of the cosines of two angles equals half the sum of the cosine of their difference and the cosine of their sum. Ibn Yunus thus transformed a product of cosines into a sum, making the use of logarithmic operations possible.

Abu-Bakr Muhammad Ibn Al-Husayn Al-Karkhi (d. 1024), of Baghdad, worked on arithmetic in his books *Al-Kafi fi Al-Hisab* and *Al-Fakhri*. He used the following approximation for the square root of a number,

$$\sqrt{a} = \frac{w + a - w^2}{1,}$$

where w is the non-fractional part of the square root. For the higher powers, he introduced concepts of *ka'b* for the cubic power, *mal mal* for x^4, *mal ka'b* for x^5, *ka'b ka'b* for x^6, *mal mal ka'b* $= x^7$, etc. He solved algebraic progressions of natural numbers to power 3, the expression $[n(n+1)]/2$ for finding the sum of natural numbers $[n(n+1)(2n+1)]/6$ for squares, and $[n^2(n+1)^2]/4$ for cubes. He solved, in addition, the problem of finding x and y when $ax^n + by^n = cz^{n-1}$ where $y = \alpha x$ and $z = \beta x$, α and β being arbitrary positive rational numbers. Al-Karkhi proved the theorem that for integers, the sum of two cubes can never be a cube. He also contributed rational solutions to certain special equations of degree higher than two, and a method for approximating solutions to linear equations.

The physicist Ibn Al-Haytham (965–1039) invented analytical geometry by establishing the close relationship between algebra and geometry, using the new technique in his study of optics. He solved the problem of drawing, from two given points in the plane of a circle, lines which intersect at those points. (This problem leads to a quadratic equation, which the physicist solved by intersecting a hyperbola on a circle.) He also tried to solve the cubic equation by conics and postulated original geometrical theorems such as that of the radical axis. Ibn Al-Haytham elaborated upon Euclid's fifth postulate, using a trirectangular quadrila-

teral (called, in the West, Lambert's quadrangle!). He proved thereby that the fourth angle is always a right angle. He assumed that the locus of a point that remains equidistant to a given line is necessarily parallel to that line – an assumption equivalent to Euclid's postulate.[7]

In the early eleventh century, Abu Al-Jud Ibn Muhammad Ibn Al-Layth proposed a method to trisect an angle, using the intersection of hyperbolas and the concept of the equilateral hyperbola. He devised methods of drawing heptagons and nonagons, and solved geometrical equations such as $x^3 - x^2 - 2x + 1 = 0$.

A Persian from Naysabur (near Mashad), 'Umar Al-Khayyam (1045–1121) did outstanding work in algebra and geometry. He formulated a law to solve any algebraic progression of natural numbers raised to any power, viz. $(1^m + 2^m + 3^m + \ldots + n^m)$, thus generalising the work of Al-Karkhi. He also solved practically all types of cubic equations by the use of conic sections.

A Turkic mathematician from Central Asia, Giyath-Al-Din Jamsid Ibn Mas'ud Al-Kasi (d. 1424), was the first to introduce fractions of base sixty and their formulae for conversion in his book, *Miftah Al-Hisab*. He was the first scientist, furthermore, to introduce decimal fractions. In another volume, *Al-Risalah Al-Muhitiyah* he expressed the value 2π taken to fifteen decimal places as 6·283185071795865. He was right to the sixth decimal.

The martyred nation of Al-Andalus produced geniuses until the last moments of its life. The mathematician Abu Al-Hasan 'Ali Ibn Muhammad Al-Qalsadi (1412–86) came from Bastah, today's Baza (Spain). In his book, *Kasf Al-'Asrar 'An 'llmAl-Gubar*, he introduced the algebraic symbolism now used in all countries. He used ش to denote the symbol for square root, ك for the unknown quantity or x, ح for the square, م for the cube, and ل for equality. For instance, he would write the equation $5^2 = 12x + 54$ as (54 $\bar{1}\bar{2}$ كمل). He also hinted at the possibility of finding the square root of a quantity by ratios of series. As an example, he gave as the approximate value of $\sqrt{x^2 + s}$ the quantity $(4x^3 + 3xs)/(4x^2 + s)$.

The sixteenth-century Algerian Ibn Hamzah Al-Maghribi went even further than Ibn Yunus towards logarithmic operations through his work on geometric progression. He established, indeed, an important theorem: The order of any given term of a geometric progression, starting with unity, equals the sum minus unity of the powers of the common ratio of the two terms whose product equals the given term.

One of the last great Muslim mathematicians was the Persian Baha' Al-Din Muhammad Ibn Husayn 'Al-Amili (1547–1622), who came from Isfahan. In his book, *Khulasah Al-Hisab*, he devised an approximate law to find the square roots of 'deaf' numbers:

e.g. $$\sqrt{x} = a + \frac{h}{2a+1}, \text{ where } h = (x - a^2),$$

h and a being exact numbers. He did extensive work in algebra and arithmetic.

Physics

The most important work of the ninth-century Baghdad physicist Musa Ibn Sakir and his sons Muhammad, Ahmad and Hasan, was the *Kitab Al-Hiyal*; it described the laws of mechanics and the problems of stability. The mathematician, Al-Kindi (801–70), was a pioneer in optics having to do with the reflection of light; he was also the first to develop a theory of musical sounds. Another important contribution to physics was *Risalah Al-Khala'*, the work of the Turkish philosopher Abu Nasr Al-Farabi (872–950), which described experiments to prove the existence of vacuum. Al-Farabi studied the sounds of music, too, in terms of air waves. The Egyptian, Abu Sa id Abd-Al-Rahman Ibn Yunus (d. 1009) invented the pendulum, deduced its workings and used it to measure time well before the era of Galileo.

Ibn Al-Haytham (965–1039) of Basrah (Iraq) is without question the father of modern optics. In his book, *Kitab Al-Manadhir*, he proved the law of refraction of light, the credit for which was claimed centuries later by Snell van Royen. He established tables of incidence and refraction of light crossing the interface of two different media. He related twilight to atmospheric refraction, estimating the sun's depression below the horizon to be 19° at the beginning (morning) and end (evening) of the phenomenon. (The accepted value today is 18°.) On this basis, he estimated the height of the homogeneous atmosphere to be about 88 km.

Ibn Al-Haytham also formulated laws governing the formation of images in spherical and parabolic mirrors; he explained spherical aberration and the magnification produced by lenses. He regarded, rightly, the *sabakiyah* of the eye to be its sensitive part; he refuted Greek optical doctrines and proved that the eye receives images of objects by reacting to light received from them (and not the opposite); he concluded that an object's form is transmitted by the eye's lens. He came across the *camera obscura*, which almost led him to photography. Using geometry, Ibn Al-Haytham solved the problems of reflection of an aplanatic surface and of finding a point on a concave mirror. His work led to the fundamentals of the manufacture, centuries later, of lenses. Together with the Persian physician Ibn Sina (930–1037), he was the first to say that light has a finite velocity.

Also studied by Ibn Al-Haytham was the movement of bodies. He deduced that movement is a directed quantity (a vector), and that a

projectile acting on a body has a force consisting of a component parallel to the direction of movement and another perpendicular to it. He maintained that a body moves perpetually if there is no force to stop it or change its movement. And he proved that two equal forces can be replaced by a third equal to their sum and acting on a point equidistant between them.

Sound was the favoured subject of another scientist, Al-Jaldaki. In his book, *Asrar Al-Mizan*, he stated that 'undulation is not a transport movement of water or air, it is an effect which occurs action after action and stillness after stillness'. He added that 'echo occurs with the reflexion of undulation of air as it strikes a high mountain or wall. It happens that echo is not perceived for short distances [because of] the small time existing between hearing the sound and hearing its echo'.

It was another scientist from Khawarizm, Abu Rayhan Muhammad Ibn Ahmad Al-Baruni (973–1048), who had a good 'feel' for the speeds of sound and light. He noted that 'the speed of light, if measured with respect to the speed of sound, would be found to be extremely large'. Al-Baruni also measured the specific gravity of metals and non-metallic materials with great accuracy: time proved him right to within a few percentage points. He also did extensive work on artesian wells, explaining their operation in terms of pressure.[8]

Abu Al-Fath 'Abd-Al-Rahman Al-Khazin of Marw (now Mary, in Soviet Central Asia) was one of the most brilliant physicists of the early twelfth century. His book *Mizan Al-Hikmah* dealt mainly with mechanics and hydrostatics. Al-Khazin measured the weight and density of air, observing that air like liquids has lifting force and that the weight of a body immersed in air is less than its real weight. He studied the surface tension of liquids, measuring their specific density. He knew that the density of water changes with temperature or salinity, measuring these values accurately.

Many experimental results, claimed hundreds of years later by scientists such as Evangelista Torricelli, were obtained – with even more accuracy – by Al-Khazin. He was the first to use the aerometer to measure fluid density and temperature; he invented a scale with which to weigh solids in water and air. He believed in the existence of attractive forces holding together minute parts of the same body (van der Waal's force, so-called) and in the force of gravity (later attributed to Newton). Al-Khazin was the first to understand the exact relationship between the velocity of a falling body, the length of its trajectory, and the time elapsed – all laws rediscovered by Galileo in the seventeenth century.

One of the last great Muslim physicists was the Persian, Qutb Al-Din Mahmud Ibn Mas'ud Al-Shirazi (1236–1311), who wrote on mechanics, optics and atmospheric phenomena. He was the first to explain that the

rainbow results from the refraction of the sun's rays inside tiny water drops in the air. After his time, it is true that Muslim physics declined in both quantity and quality.

Astronomy

Translation of the works of astronomy of the ancients in Arabia began during the Ommayads and continued under the first Abbasids. Ibrahim Ibn Habib Al-Fazari (d. 777) translated many Indian books, but he was the first Muslim scientist to do original work in astronomy. He invented the astrolabe and predicted lunar and solar eclipses; he worked on the lunar year, the movement of stars, and the timing of prayer. Later, books were translated from the Greek, especially Ptolemy's *Al-Majsati* (Almagest) by Al-Hajjaj Ibn Yusuf. Soon observatories were built throughout Muslim lands, attracting astronomers from everywhere.

The first great achievement was undoubtedly that described by Abu Al-Tayyib Sind Ibn 'Ali (ninth century) as reported by Ibn Yunus in his manuscript *Kitab Al-Zayj Al-Kabir Al-Hakimi*, a copy of which is at Leyden (Netherlands). A group of Muslim astronomers had been ordered by Al-Mamun to measure the earth's circumference. They did this by measuring the length of the terrestrial degree in two flat deserts; they found the degree to be 56·666 Arabian miles (111·812 kilometres), which brought the circumference to 40,253·4 kilometres. The exact figures are 40,068·0 kilometres through the equator, 40,000·6 through the poles.

The mathematician Al-Khawarizmi, appointed court astronomer by Al-Mamun, was the first to compile astronomical tables; he computed planetary motion, the obliquity of the ecliptic and delicate geodesic measurements. The mathematician Al-Kindi, already mentioned, developed a spherical model of the universe and, using geometry, argued that its body is finite. (He also proved that the surface of the oceans, and consequently of the earth, is spherical.) He designed a skeleton sphere to represent the positions of the ecliptic and other celestial circles.

Another mathematician, Al-Battani (850–929), measured the increase in longitude of the solar apogee since Ptolemy's time in A.D. 150 as 16°17′ – discovering in the process the motion of solar apsides resulting from a slow variation in the equation of time. He measured the earth's yearly precession as 54·5 seconds, the inclination of the ecliptic as 23 degrees 35 minutes, and the length of the solar year as 365 days 5 hours 46 minutes (an error of 2 minutes only). Al-Battani calculated by a simple trigonometric rule the maximum, average and minimum distances to the sun as 1146, 1108 and 1070 earth radii; he was off distance by a factor of only 20, but his value of eccentricity was close to reality. He compiled a catalogue

of fixed stars for the year 880–81 as well as astronomical tables relevant to the motion of the sun, moon and planets.

Abu Al-'Abbas Ibn Muhammad Ibn Kathir, an astronomer of the ninth century from Farghana in Central Asia, devoted his energies to measuring the distances from the earth to the moon and planets. The values he established in terms of terrestrial radii for the lunar (64·166) and Martian (8,876) distances were incredibly close to exactitude (64·376 and 8,841, respectively). He measured accurately the volume of the moon in terms of that of the earth, and found as well the relative volumes of the sun, Mercury, Venus, Mars, Jupiter and Saturn – values used by scientists until the time of Copernicus.

'Abd-Al-Rahman Al-Sufi (903–86), who was born at Rayy near Teheran, established tables of fixed stars and drew maps of their celestial positions: he named more than a thousand stars by groups representing animals. This system is still in use, and the European names of these stars are his invention: Algorab (from Al-Ghurab) Deneb (Al-Dhi'b) Aldebaran (Al-Dabaran) and Benetnasch (Banat Nas's). Another Persian, Muhammad Ibn Muhammad Al-Buzjani (940–98), discovered the wobble in the motion of the moon, a find claimed centuries later by Tycho Brahe.

Ibn Al-Haytham, of whom we have already spoken several times, used optics to determine exact stellar positions, taking into account the atmosphere's refraction with altitude. He proved geometrically the law relating a star's latitude with its time of passage through the zenith (*samt*) and explained why spherical bodies appear as discs.

Six hundred years before Galileo, Al-Baruni had claimed that the earth rotates round its axis. Using the astrolabe and the presence of a high mountain near a sea or flat plain, he calculated the terrestrial circumference by solving a highly complicated geodesic equation. He also fixed scientifically the direction of Makkah from any point on the globe.

An Andalusian from Qadis (today's Cadiz, Spain), Ibn Tufayl (d. 1185), wrote a philosophical book – *Hayy Ibn Yaqdhan*, later emulated by Dante Alighieri in his *Divine Comedy* – in which he theorised on the unity of the laws of the universe and their permanence (he believed that the universe is finite). He refuted the Ptolemaic model, as did most Muslim scientists before him, and tried to approach it to reality.

One of the greatest achievements of the Syrian 'Ala' Al-Din 'Ali Ibn Ibrahim Ibn Al-Satir (1306–75) was his lunar theory, to be attributed to Copernicus more than 150 years later. He assumed an elliptical path of the sun, rather than a circular one as had Ptolemy, eliminating the exaggerated variance in the lunar distance as proposed by Ptolemy. Ibn Al-Satir used only those motions resulting from a combination of uniform circular motions. His system consisted of constant-length vectors rotating

at a constant angular velocity, and he abandoned the Ptolemaic equant, as Copernicus did many years later.

Ibn Al-Satir also investigated the movement of celestial bodies, determining the obliquity of the ecliptic at Damascus in the year 1364 to be 23 degrees, 31 minutes. Today, we know that the exact figure is 23 degrees 31 minutes 19·18 seconds. He devised many astronomical instruments, regularly made precise observations, and published *Rasd Al-Satir* as his most important work.

Among the last of the outstanding Muslim astronomers was Shamduddin Muhammad Ibn Muhammad Al-Rudani (1627–83), who hailed from Tarudant (Morocco). He invented a spherical engine to measure time, an instrument which functioned within shells and could be operated at any longitude or latitude.

Chemistry

In chemistry as in other fields, Muslim scientists first translated the books of the ancients into Arabic. But Greek chemical research had been enmeshed with philosophical arguments and mythical aims, such as the stone of wisdom which converts base metals into gold and the elixir of life that permits eternal health and youthfulness. It was the Muslims who first gave experimentation in scientific analysis the place it deserves in science; they were the first to check the value of different chemical theories by experimentation. In the process, they discovered many new products, the names of which in European languages still bear an Arabic flavour: chemistry, *al-kimiya'*; alambic, *al-alambiq*; alcohol, *al-kuhul*; alkaline, *al-qalawi*; arsenic, *al-zirnikh*, and the like.

Muslim scientists often were able to develop an unknown process into a full-fledged industry that changed the world's economy, the paper industry being an obvious example. It began in 751 when Ziyad Ibn Al-Salih, Muslim governor of Samarkand in Central Asia, sent a military expedition to China. This force returned with several prisoners who taught the Muslims a primitive way of fabricating paper. By 794, Al-Fadl Ibn Yahya Al-Barmaki, Muslim governor of Khurasan, had developed the process and built the first paper factory. Al-Tha'alibi mentions its success, in his book *Lata'if Al-Ma'arif*, in these terms:

> The papers of Samarkand eliminated the papyrus of Egypt and the skins on which the ancients used to write, because these papers are better, thinner, handier and more practical.

The industry reached Syria and Egypt by the ninth century, Al-Andalus (Muslim Spain and Portugal) in the tenth century, and North Africa in the century following. Specimens of the papers manufactured are to be found in Spanish libraries, notably the Escorial.

Jabir Ibn Hayyan Al-Kufi (738–813) from Kufah in 'Iraq was the first great Muslim chemist and, beyond doubt, the father of modern chemistry. Working in his laboratory near the Bawwabah of Damascus he based his experiments on the five senses, using materials of metallic, vegetal and animal origin. He ended the descriptions of his experiments as follows: 'I knew it first with my hand and my brain, and I researched it until it became right, and I looked for errors in it.'

Ibn Hayyan devised instruments for cutting, calcining and crystallising. He perfected the basic processes of sublimation, evaporation, liquefaction, crystallisation, calcination, distillation, ceration (waxing), purification, solution, fixation, roasting, coction, amalgamation and oxidation, describing them all. He differentiated between direct distillation using a wet bath and indirect distillation using a sand bath. Ibn Hayyan claimed that water can be pure only by distillation, otherwise 'impurities in water are dissolved within it and purification would have no effect'.

The chemist identified many new products, including alkalines, acids, salts, paints and greases. He prepared sulphuric acid, nitro-hydrochloric acid (aqua regia or royal water, a mixture of nitric and hydrochloric acids used to dissolve metals such as platinum and gold), caustic soda and even the beverage Danziger Goldwasser. He also produced CH_3COOH (which he called vinegar acid) and a multitude of salts such as sulphates, nitrates and both potassium and sodium carbonates; he devised a product to keep clothes dry and another to prevent rust. He prepared paints of different colours for use on clothes and animal skins, as well as an ink to be used for expensive manuscripts.

In all, Ibn Hayyan wrote more than 500 studies in chemistry, but few of these have reached us. His most famous books are *The Seventy*, *The Acids*, *The Poisons*, *Nihayah Al-Itqan*, *Risalah Al-Afran* and *Al-Sun'ah Al-Ilahiyah wa Al-Hikmah Al-Falsafiyah*. A statement taken from the last of these reflects the greatness of this scientific mind:

> Mercury and sulphur unite to form one single product, but it is wrong to assume this product to be entirely new and that mercury and sulphur changed completely. The truth is that both kept their natural characteristics and that all that happened is that parts of the two materials interreacted and mixed, in a way that it became impossible to differentiate them with accuracy. If we were to separate . . . the tiniest parts of the two categories by some special instrument, it would have been clear that each element (*'unsur*) kept its own theoretical characteristics. The result is that chemical combination between the elements occurs by permanent linking without change in their characteristics.

The next great Muslim chemist was the Persian, Abu Bakr Muhammad Ibn Zakariya Al-Razi (854–932). He prepared sulphuric and other acids

as well as alcohol by fermenting sweet products, studied mercury and its compounds, and described the design and use of more than twenty instruments for use in chemistry. Al-Razi perfected the process of experimentation by describing first the materials he used, then the apparatus, methods and conditions of the experiment. He was the first to divide chemical products into the categories of mineral, vegetable and animal, and it was he who declared that the functioning of a living body is based on complex chemical reactions.

Abu Al-Qasim Salamah Ibn Ahmad Al-Majriti (950–1007), the Andalusian from Majrit (today's Madrid), was the first to prove the principle of conservation of mass – credit for which was claimed 900 years later by Lavoisier. His relevant experiment is described in his work, *Rutbah Al-Hakim*, in the following terms:

> I took clean, shining mercury and I put it in an egg-shaped utensil made of glass, and I introduced it into another utensil similar to kitchen utensils. I let it warm under such a low fire as I could put my hand on the outer surface of the instrument. The heating continued for forty days, and when I opened the instrument I found the mercury (which weighed a quarter of a pound) had been transformed into a red powder *without any change in the overall weight.*

The red powder was, of course, mercury oxide (HgO). Compare this experiment with that of Lavoisier.

The physician Ibn Sina (980–1037) developed accurate theories on the formation of metals, rocks and mountains. He opposed the belief that metals could be converted easily into gold, 'because each metal has its own constitution which cannot be changed by the methods of transformation known to us'.

Other Muslim chemists included the Palestinian Muhammad Al-Tamimi Al-Maqdisi (tenth century), the Iraqi Ibn Jazlah (d. 1080), the Andalusian Abu Al-Hasan 'Ali Ibn Irfa' Al-Ra's (d. 1197) who wrote *Rizam Mina Al-Dhahab*, the Iraqi Abu Al-Qasim Muhammad Ibn Ahmad Al-'Iraqi (thirteenth century) who described methods of producing gold in his work *Al-Muktasab fi Kayfiyati Intaji Al-Dhahab*, and the Turk 'Izz Al-Din Aydamir Ibn 'Ali Al-Jildaqi (d. 1361).

Medicine

The first Muslim hospitals were established during the lifetime of the Prophet in Medina, including field hospitals of the Muslim army. As the Muslim State grew, general hospitals were created in every city. The first specialised institution was built by the Umayyad Al-Walid in Damascus in the year 707 – a leprosarium. (The Umayyads also established military hospitals, mobile hospitals and institutions specialising in mental

diseases.) Under the 'Abbasid Al-Mamun in the ninth century, pharmacies became well organised under the control of the State. Each city had its official chief pharmacist.

Translations of specialised texts began early, as the Muslim State inherited such famous schools of medicine as that of Jundisabur, in southern Iraq. The greatest translator was undoubtedly the Nestorian Christian, Abu Zayd Hunayn Ibn Ishaq Al-'Abbadi (807–77), who came from Al-Hirah (Iraq). He translated Greek works, especially those of Hippocrates, Galen, Paul of Aegina and Dioscorides. He wrote original works of medicine, especially on the eye, its constitution and maladies, and on pharmacology.

The first great Muslim physician was the Persian, Abu Bakr Muhammad Ibn Zakariyya Al-Razi, who lived from 850 to 912: first as chief physician of the Rayy Hospital near Tehran, then in the same capacity at Baghdad Hospital. An outstanding surgeon, he was the first to differentiate smallpox from measles and to write about them. He has left us *Kitab Al-Hawi*, a medical encyclopaedia in twenty-four volumes in which he recorded his clinical cases with great accuracy. He described disorders such as renal abscesses, aortic regurgitation, ophthalmia, the spitting of blood (or haemoptysis) and temporary baldness, or alopecia. Another work, *Al-Mansuri*, became a medical textbook used for several centuries.[9]

Al-Razi also wrote a book on diet and another, *Sirr Al-Asrar*, on pharmacology, in which he divided remedies into mineral, vegetal and biological categories and described their functioning. He always tried new medicines first on animals, studying their side effects. He used opium and *hasis* in anaesthesia, and produced in his laboratory such salts as NaOH (sodium hydroxide) and potassium carbonate.

Another medical textbook, *Al-Kitab Al-Malaki*, both theoretical and practical in nature, was written by the Persian physician, 'Ali Ibn Al-'Abbas Al-Ahwazi (d. 940). This author was the first to mention a network linking veins and arteries. He also pointed out the difficulty of healing from tuberculosis because of the lung's movement and treated by surgery infections of the lymphatic glands and tonsils. Al-Ahwazi was an outstanding osteopath, having treated luxations (dislocations) and such vexing bone fractures as that of the lower jaw. He placed written indications on his patients' beds in the follow-up of their improvement. In pharmacology, he prepared and described various pills, powders, syrups, ointments, purgatives and dentifrices.

Abu Al-Qasim Khalaf Ibn 'Abbas Al-Zahrawi was a surgeon born in 936 at Qurtubah (Cordova) who described his operations and surgical instruments in a thirty-volume work titled *Al-Tasrif Liman 'Ajaza 'ani Al-Ta'lif* – a standard text for more than five centuries. He perfected

delicate operations such as the extraction of stones from the bladder, removal of a dead foetus and amputation. He wrote on gynaecology, disorders of the eye and the ear, and dentition. Many of the instruments he used were of his own invention.

The physicist Ibn Al-Haytham, whose life of 73 years spanned the tenth and eleventh centuries, illustrated the operation of the eye and named its parts: *al-sabakiyah* or retina, *al-qurniyah* or cornea, *al-sa'il al-ma'i* or aqueous humour, and *al-sa'il al-zujaji* or vitreous humour. His explanations were accurate and his work on lenses prepared the way for their use to correct eye defects.

One of the many geniuses produced in the region of Bukhara (Central Asia) was Abu 'Ali Al-Hasan Ibn 'Abd-Allah Ibn Sina, or Avicena (980–1037), the first expert to describe meningitis correctly, differentiate between mediastinitis and pleurisy, and discover the contagious nature of tuberculosis. He described the diseases causing jaundice and divided between organic and non-organic the origins of facial paralysis. He studied troubles of the thorax and described accurately brain haemorrhage and ankylostomiasis, a disease caused by a worm which makes its habitat in the upper part of the small intestine. Ibn Sina's medical textbook, *Al-Qanun*, became the standard work of both the Muslim and European worlds for the next 500 years. The author also did outstanding work in anatomy, child health, gynaecology, sterility and genital disorders.[10]

Abu Al-'Abbas Yahya Ibn 'Isa Ibn Jazlah, an Egyptian who died in the year 1080, compiled an encyclopaedia on pathology, *Kitab Taqwim Al-Abdan*; in it, he gave clinical descriptions of all known diseases, including cancer. In a second work, on pharmacology, *Kitab Minhaj Al-Bayan*, the same specialist listed the medicinal plants and their curative effects.

An Andalusian from Ishbiliyah (Seville), Abu Marwan 'Abd-Al-Malik Ibn Abi-Al-'Ala'Ibn Zahr (1091–1162) – the most prestigious member of a family of physicians – made clinical observations as important as those of Ibn Sina, especially on leprosy. He also wrote a general medicine, pharmacology and diet. A contemporaneous Andalusian, Abu Ja'far Ahmad Ibn Muhammad Al-Ghafiqi, was a pharmacologist from Ghafiq (the Hinojoza del Duque of our day). His book *Al-Adwiyah Al-Mufradah* presented detailed descriptions of medicinal plants, showing their names in Arabic, Berber and Latin.

A third Andalusian, this one from Malaqah (Málaga), proved to be the greatest Muslim pharmacologist. He was Abu Muhammad 'Abd-Allah Ibn Ahmad Ibn Al-Baytar (1197–1248), who travelled to many Muslim and non-Muslim countries to collect information about remedial plants. Of the 1,400 medicaments described in his *Al-Jami' fi Al-Adwiyah Al-Mufradah*, 300 were his own discoveries.

A Syrian from Damascus, 'Ala' Al-Din Abu Al-Hassan 'Ali Ibn Abi

Al-Hazm Ibn Al-Nafis (1210–98), was a physician of rare genius considered by many to have outpaced Ibn Sina. In his book *Sarh Qanun Ibn Sina*, he corrected many of the other's errors, especially concerning the arteries joining heart and lungs. Ibn Al-Nafis was the first to describe correctly the blood's circulation through the small vessels, a find claimed by European physicians about three centuries later – in terms translated literally from those of the Damascene.

The blood's circulation is even described five times in the Syrian physician's works. He was the first to understand how the lung is made and to describe the bronchi and the connexions between the body's air and blood conduits. He also defined the function of the coronary arteries as feeding the cardiac muscle.

After the work of Ibn Al-Nafis, Muslim creativity in medicine began to decline. Yet the fourteenth and fifteenth centuries produced three great names in the field: the 'Iraqi Yusuf Ibn Isma'il Al-Kutbi, the Turk, Khadir Ibn 'Ali Hajji Basha, and the Syrian Christian, Daud Al-Antaki (d. 1599).

Geography

Muslims developed the magnetic needle for use in navigation and invented the mariner's compass as well as the astrolabe already mentioned. They established new land and sea routes to link Asia, Africa and Europe, together with ports and a network of land stations (*marahil*). They built ships in factories they called *dar al-sina'ah* (arsenals), and each ship had as its master an *amir al-bahr* (admiral). The Muslims used a new method to find their way by the stars and map sea routes; they fixed the meridians of longitude and parallels of latitude, thus creating spherical cartography.[11]

The Muslims explored China, Japan, India, South-East Asia and the Indian Ocean; Europe, including Scandinavia, Ireland, Germany, France and Russia; and the Mediterranean, as well as Africa. They reached the polar regions and knew of the existence of a land beyond the Atlantic Ocean which the *Al-Subban Al-Maghrureen* (Overconfident Young People), reported by Al-Sarif Al-Idrisi (1100–1180), tried to reach from Muslim Al-Usbunah or Lisbon.

The mathematician Al-Khawarizmi, already mentioned, had contributed to the measurement of the earth's circumference. By order of the caliph Al-Mamun he also helped draft the first Muslim geographical map of the known world, and his book *Surah Al-Ard* expanded on the geography of Ptolemy.

The ninth century had many proficient Muslim geographers and explorers. There were, for example, Ahmad Ibn Ya'qub Al-Ya'qubi who described his travels in the volume *Kitab Al-Buldan* and the geographer 'Ubayd-Allah Ibn 'Abd-Allah Ibn Khurd Dhabah (825–912) who pub-

lished the book *Al-Masalik wa Al-Mamalik* (Paths and Kingdoms). In the next century, the 'Iraqi Abu Al-Hasan 'Ali Ibn Al-Husayn Al-Mas'udi published a detailed atlas of all the known world. The Persian Zahrab described in the utmost detail the river and irrigational systems of the Nile, the Tigris and the Euphrates, whereas his countryman Abu Muhammad Al-Hasan Ibn Ahmad Ibn Al-Ha'ik specialised in the Arabian peninsula. Another geographer of the Muslim world was Abu 'Abd-Allah Muhammad ibn Ahmad Al-Maqdisi, born in 947.

Among the many travellers, I shall mention Abu Zayd Al-Hasan Al-Sayrafi, who reported on his travels to India and China in his book *Akhbar Al-Rahalat*; Ahmad Ibn Fadlan Ibn Hammad, who recounted his trip to the Volga basin in 921 (the first of its kind); and Abu Dalf Mus'ir Ibn Al-Muhalhal Al-Yanbu'i, who chronicled his voyages to India, Afghanistan, Tibet and China.

Two names stood out in the eleventh century. There was the Andalusian from Walbah (today's Huelva), Abu 'Ubayd 'Abd-Allah Ibn'Abd Al-'Aziz Al-Bakri (d. 1094), who left a general geographical guide and a special geographical dictionary covering the Arabian peninsula. There was also a Persian named Nasir Khasru Al-Qabadhiyani (1003–61), who toured most of the Asian continent. An Andalusian from Gharnatah (Granada), Abu Hamid Muhammad Ibn 'Abd-Al-Rahman Al-Qaysi (1080–1169), visited eastern Europe and Russia; he became chief *qadi* of the Muslims of Hungary and chronicled the Maghribi emigration to the east of Europe.

The greatest of the Muslim geographers was surely the Moroccan from Sabtah (Ceuta), Abu 'Abd-Allah Muhammad Ibn Muhammad Al-Sharif Al-Idrisi (1100–80). He did most of his work, however, for the Norman King Roger of Siqilliyah (Sicily) at the capital of Balram (Palermo) after the island had been seized by the Norman Crusaders from the Muslims. More than a mere traveller and accomplished geographer, Al-Idrisi founded the discipline of mathematical geography; he created the system of cylindrical projection of the earth's surface, later (1569) to be claimed as his own by the Fleming, Gerard Mercator. Dividing the earth into seven *aqalim*, Al-Idrisi called the area lying between any two meridians of longtidude *iqlim*. He divided each *iqlim* into ten regions. Thus his map of the world consisted of seventy sheets.

An Andalusian from Balansiyah (Valencia), Abu Al-Husayn Muhammad Ibn Ahmad Ibn Jubayr (1145–1217) travelled in the Arab countries, recording the social situation in what was left of the Crusader-occupied States around their stronghold of 'Akkah (Acre, a port city in Galilee). He also reported on the horrible conditions of the Sicilian Muslim community under the Norman colonisers, accurately predicting their doom. And a Greek Muslim, Abu 'Abd-Allah Yaqat Ibn 'Abd-Allah

Al-Hamawi (d. 1223), was the compiler of the impressive Muslim geographical dictionary, *Mu'jam Al-Buldan.*

In the thirteenth century, the geographers of note were Abu Al-Hasan 'Ali Ibn Musa Ibn Sa'id (1210–80), an explorer from Granada; Abu Muhammad Ibn Muhammad Al-'Abdari from Valencia, who concentrated on North Africa; and the Moroccan Abu 'Abd-Allah Muhammad Ibn 'Umar Ibn Rashid, who recorded voyages to Al-Andalus and North Africa. In the following century, another Moroccan, Abu 'Abd-Allah Muhammad Ibn 'Abd-Allah Ibn Battutah (1303–77), proved to be the greatest Muslim traveller of all. Leaving his base at Tanjah (Tangiers), he spent thirty years voyaging as far eastward as the Maldives, the Indonesian archipelago, Indochina and China.

The prime Muslim authority on the Indian Ocean was Shihabuddin Ahmad Ibn Majid (1433–1536) of 'Uman (Oman). Known by the Muslims of the time as the Lion of the Sea, Ibn Majid led Vasco da Gama across the Indian Ocean as captain of da Gama's ship. At about the same time, the first European to set foot on the soil of the New World, Rodrigo de Lope, a member of Christopher Columbus' expedition, was none other than a son of the great nation of Andalusian Muslims. On de Lope's return to Spain, he declared openly his faith in Islam despite the on coming Inquisition.

Among the last of the significant Muslim explorers were three whom I shall mention to close this section. Muhammad Ibn Al-Hasan Al-Wazzan (1483–1552), migrated with his parents from his native Granada when that city was lost to the Muslims in 1492. From Morocco he travelled to the Muslim East; upon his return, he was captured by Christian pirates on the coast of Tunis. He was sold as a slave to Pope Leo X, who forced upon him both Christianity and the name Giovanni Leone Africanus. Al-Wazzan succeeded in freeing himself a few years later; he returned to Tunis and compiled a book on the topography, peoples, flora and fauna of Africa. (His book was plagiarised by Mármol and other European historians.) Two other explorers: a Greek, Pir Muhyi-Al-Din (d. 1555), an outstanding Mediterranean navigator, and the sixteenth-century Turk, Awliyah Chelebi, who has left the best account of Eastern Europe under Ottoman rule.[12]

The inquisitive research of Muslims did not stop with the branches mentioned throughout this chapter; it encompassed all known fields of learning and introduced new ones.

Characteristics of the Golden Age

I have given this fairly lengthy survey of Muslim contributions to science and technology to highlight the value system that made this great achievement possible. This value system is still present, but dormant, in a world

community of one billion people who still identify with it but find themselves far away from contemporary leadership in science and technology.

The main characteristics of this Golden Age were: (1) universalism; (2) tolerance; (3) international character of the market; (4) respect for science and scientists; and (5) the Islamic nature of both the ends and means of science.

Islamic universalism emerges from the fact that the only link of togetherness acceptable in Islam between individuals is the link of common belief and common purpose in life. All Muslims are linked in the single bond within one supra-national community, the *Ummah*. The *Ummah* has been defined in the Qur'ān itself as those who 'enjoin what is right, forbid what is wrong, and believe in God'. The *Ummah* is, therefore, not a 'nation' only, nor is it a 'religious community'. It is both and more: it is a Model. For a Muslim, the definition of 'us' with respect to 'others' within the *Ummah* goes beyond the links of family, race or geography. It is embedded in the Islamic belief itself. The Prophet Mohammed stressed the fellowship of all Muslims in so many terms and, above all, in his practice itself. He said: 'Muslims are like one single body, if one part of it hurts, the entire body hurts with pain and fever.' He also said: 'None of you becomes a true believer unless he wishes for his brother what he wishes for himself.'

However, this cohesiveness within the *Ummah* does not go against the others ouside it. Muslims are well aware that they are part of humanity as a whole. The entire humanity is the *Ummah* of Mohammed since God sent him as a messenger to mankind. The scholars of the Golden Age had an all-encompassing outlook. They were willing to build upon ideas developed by non-Muslims, either their contemporaries or predecessors. It was this characteristic that enabled them to assimilate and synthesise so much knowledge in such a short period in the early years of Islam.

This universalism combined with tolerance made the exchange of ideas and acceptance of foreign talent possible. As a result, Islamic scientific community was distinctively cosmopolitan in race, language and even religion. They were all bound by a common view of the world, a common cultural language and were indeed part of a common scientific milieu.

Scientists of this period travelled extensively throughout the Muslim world which at that time encompassed some 40 million square kilometres and comprised most of the civilised world. Scientists were free to move within this vast area and were treated as citizens wherever they happened to be. Even when the political supremacy of the Muslim world was lost, this situation did not change. A Muslim scientist often spent his lifetime under several political systems which vied with each other to attract him

and facilitate his work. As such, the Muslim scientist and his output was a marketable commodity throughout the Muslim world.

The different governments did what they did because of their respect for science and scientists under the influence of the teachings of the Qur'ān and those of the Prophet Mohammad. The ideal of every parent was to see his child grow up to be a man of knowledge and science. Learning was viewed as a noble pursuit of greater chivalric value than geneaology.

In their turn, scientists themselves discharged their responsibility with great diligence. Like wealth, knowledge was considered by them to be a trust given by God to a person, who should use this conscientiously. This meant that their knowledge had to be used for the good of the community and had to be transmitted to others. As such, both their ways of doing science as well as the final product of their endeavour were dictated by the value system of Islam

The reasons for decline

As Islamic Civilisation developed, and Muslims moved from the position of students to that of teachers, they gained more confidence in their abilities. With the passing of centuries, this confidence transformed itself into a feeling of superiority towards the rest of mankind, a superiority not based on 'ordering what is good, forbidding what is bad, and believing in God' but on the mere fact of being Muslims or Arabs. This eventually led to complacency and to the loss of the ideals that led to the birth of Islamic civilisation in the first place. The search towards knowing God and His creation stopped, and dogmatism found its way in the *Ummah*, not only in Ibadat and Law, but in science and technology as well. The *Ummah* lost its creativity. Generation upon generation of scientists and technologists spent their lifetimes in learning the work of the great masters of the past and in copying their achievements. Eventually, this complacency led to the loosening of morals and ideals, and consequently to the continuous retardation and inefficiency of Muslim societies. Meanwhile, under the continuous pressure of Islamic civilisation, the Christian West freed itself from its own underdevelopment and established its own set of ideals to create the modern Western civilisation. It was only a matter of time before the *Ummah* discovered itself lagging in the race towards knowledge. What then became of its great ideals during this period of decadence?

The first victim was universalism. Not only Muslims as a whole started feeling apart from the rest of the world, but the political divisions of the Muslim World hardened into a balkanisation of the *Ummah*, that has reached its worst level in this time of ours. The identity within the 'us' of the *Ummah* started giving more and more of its space to other identities: national groupings, the region or the tribe within the nation, the clan within the tribe and the region, and eventually the family within the clan.

In its most disintegrated form this led to the dominance of the individual who knows no other allegiance than to himself. It was (and in many ways still is) as if the Ages of Ignorance of pre-Islamic Arabia, Mesopotamia, Egypt, Turkey and Persia came back again to take their revenge. This handicapped the movement of people, ideas and goods and opened the door to the more dynamic and aggressive movements from the West. The Muslim World found itself losing its own universalism and being slowly integrated to that of the West.

Tolerance went as well during this period. True, the Muslim World remained tolerant toward those within it who had other religious adherences. In fact, this tolerance went to the extremes of weakness exemplified in the system of 'capitulations' which eventually led to the colonisation of the Muslim World by the West. But intolerance crept between Muslims themselves. Any new idea, whether in society, science or technology, was met with harsh suppression. It was as if all was set and perfected and no one had the right any more to change it or to improve it. When new and superior technologies, often brought by the invading armies from the West, crushed for the first time the Muslim world and destroyed its empires one after the other, the shock was enormous but the intolerance of Muslims towards each other remained.

The universe into which the Muslim scientists operated became divided into a plethora of small markets. These were not viable enough to make development of any new product possible. Eventually, these markets were themselves lost to Western products and technologies.

In time, seeking knowledge was reduced to acquiring 'religious' knowledge. Interest in science and technology was lost along with the respect that society had for them. Eventually, these subjects were dropped from universities which became religious institutions only. The few who were still motivated towards the pursuit of scientific knowledge were forced to go to Western universities. Here, the knowledge they acquired was divorced from the Islamic value system. As a result, the unity of ends and means that science and technology had enjoyed under Islam was lost. The Muslim world therefore came not only under physical domination but also surrendered itself intellectually.[13]

Towards a new revival

This physical and intellectual conquest led the Muslim world to ape its masters. However, the underlying reasons for the fall of the Muslim civilisation and the rise of the West were never comprehended. Instead, the Western vices and the worst aspects of its system, such as arrogance, social Darwinism and utilitarian ethics were often copied with diligence. Instead of producing their own technologies, the Muslims simply imported hardware and other manufactures from the West.

The fact that there have been qualitatively more developments in science and technology during the last two centuries than ever before has made the stagnation of the *Ummah* even more pathetic. However, developments in communications during the last half-century have shrunk distances and overcome the barriers of geopolitical and legislative borders to bring back a feeling of togetherness within the *Ummah*. The dormant 'us' started to reawaken and a search for the reasons underlying the backwardness of the *Ummah* was initiated. This led to a rediscovery of the Islamic value system among the peoples and eventually their governments.

Before 1969 there was no forum for the disparate elements of the *Ummah* to meet and discuss their common problems: until the late King Faisal of Saudi Arabia pioneered his call for Islamic solidarity by sending his adviser Shaikh Montacer Kettani to the heads of North African states in 1965 to gather support for an idea. The effort culminated in the First Islamic Summit of Rabat in 1969 which led to the formation of the Organisation of the Islamic Conference (OIC) with its headquarters in Jeddah.[14]

OIC is now an organisation of 42 states and several agencies trying to unite the Muslim world. From the beginning it was obvious that Islamic solidarity could not be achieved without solidarity in scientific research and technological development for the common good of the *Ummah*. This realisation led to the formation of Islamic Foundation for Science, Technology and Development (IFSTAD) in 1978. IFSTAD was effectively established in 1981 with headquarters in Jeddah.

The charter of IFSTAD states the following in its preamble:

> Keeping in view the objectives of the OIC which seek to promote Islamic Solidarity among member states and to strengthen co-operation between them in the economic, social, cultural, scientific and other vital fields;
>
> Conscious of the fact that the promotion of science and technology is essential for the purpose of achieving rapid, coordinated and wide-ranging socio-economic developments of the Muslim peoples;
>
> Conscious also of the rich historical experience of the Muslim World in the fields of science and technology, and of the need to foster the distinctive Islamic culture which combines the universal spiritual and moral values of Islam with the world view of science.
>
> And in the implementation of the Resolutions adopted by the 6th, 7th, 8th and 9th Islamic Conferences of Foreign Ministers, in this respect:
>
> The member states of the OIC have decided to set up a subsidiary organ

for science, technology and development, in terms of Article V (paragraph 5) of the Charter of the Islamic Conference.

The objectives of IFSTAD have been defined to be:

1 To promote and encourage research activities in the fields of science and technology within an Islamic framework to help solve some of the current problems of the Muslim World and of mankind in general.
2 To promote cooperation and coordination in the fields of science and technology within the Islamic World in order to strengthen the bonds of Islamic Solidarity.
3 To ensure that all member countries of the OIC, both individually and collectively, make the greatest possible use of science and technology (including the social sciences) in the formulation and implementation of their socio-economic plans, keeping in view the need to consolidate the unique Islamic personality and character.
4 To provide advice and carry out scientific studies for the Islamic Conference, whenever necessary.[15]

If IFSTAD succeeds in being a tool in rekindling the spirit that led to the birth of the Islamic scientific and technological civilisation, then its inception will have certainly been a sign of a new revival.

The underlying force behind this new revival must of course be the Islamic value system. The Muslim world has to recreate the characteristics of the Golden Age: universalism, tolerance, respect for science and scientists, the unity of both the ends and means of science, and an unrestricted climate for the free movement of scientists, technologists and their products within the *Ummah*. A civilisation that stops thinking about its own problems and trying to find indigenous solutions to them is doomed to be marginalised. Islam with its universalism, tolerance, respect for humanity and belief in the inherent goodness of man is the only way for the scientific and technological progress of the Muslim world. As the Prophet Mohammad once said: 'the latter days of this *Ummah* would be improved only by what improved its beginning'.

References

1 For a general introduction to Islam and its value system see: Hammudah Abdalati, *Islam in Focus*, American Trust, Indiana, 1980, and A.R. Azzam, *The Eternal Message of Mohammad*, Quartet, London, 1980.
2 This section is based on my paper, 'Muslim contribution to the Natural Sciences', *Impact of Science on Society* 26 (3) 1976. A general introduction to the subject can be found in S.H. Nasr, *Science and Civilization in Islam*, Harvard University Press, 1968. For a more detailed background see: G. Sarton, *Introduction to the History of Science* (3 vols), Williams and Wilkins, Baltimore, 1927.

3 See: ch. 6, D.M. Dunlop, *Arab Civilization to AD 1500*, Longman, London, 1971.
4 See: A.A. Al-Daffa, *The Muslim Contribution to Mathematics*, Croom Helm, London, 1977; and D. Smith, *History of Mathematics*, Ginn and Co, Boston, 1923–25.
5 Sarton, *op. cit.*, vol. 1, p 563.
6 G.N. Atiyah, *Al-Kindi*, Islamic Research Institute, Rawalpindi, 1966.
7 See: I Sabra, 'Ibn al-Haytham', *Dictionary of Scientific Biography*, Scribner's, New York, 1970, Vol. 4, pp. 189–210; and H.M. Said (ed.), *Ibn al-Haitham*, Hamdard Foundation, Karachi, 1965.
8 See: the massive H.M. Said (ed.), *Al-Biruni Commemorative Volume*, Hamdard Foundation, Karachi, 1979; and the entire issue of *Unesco Courier* (June, 1974).
9 See M. Ullmann, *Islamic Medicine*, Edinburgh University Press, 1978; and Cyril Elgood, *Safavid Medical Practice*, Luzac, London, 1970.
10 G. Wickens (ed.), *Avicenna (Ibn Sina): Scientist and Philosopher*, Luzac, London, 1952.
11 Nafis Ahmad, *Muslim Contribution to Geography*, Ashraf, Lahore, 1965.
12 For a wide-ranging introduction to the Ottoman contribution to science and technology see: *Proceedings of the International Congress of Turkish-Islamic Science and Technology*, Istanbul, 1981 (5 vols).
13 See: Ziauddin Sardar, 'Can Science Come Back to Islam?' *New Scientist*, 88, pp. 212–16 (23 October 1980).
14 See: H.H. Kizilbash, 'The Islamic Conference: Retrospect and Prospect', *Arab Studies Quarterly*, 4, pp. 138–56 (Spring 1982).
15 IFSTAD is developing so rapidly that Ziauddin Sardar's account of the Foundation in *Science and Technology in the Middle East*, Longman, London, 1982, is already slightly out of date.

6 Islamic values and Western science: a case study of reproductive biology

MUNAWAR AHMAD ANEES

The Muslim scientists of the Golden Age were well aware that certain branches of knowledge were at the interface of good and evil. This is precisely why scientists like al-Razi, al-Zahrawi and ibn Sina insisted that both their methodologies and the final product conformed to the requirement of Islamic value system. As Ali Kettani has argued, one of the characteristics of this period was the unity of the ends and means of science and technology. My aim in this paper is to highlight the areas where some of the requirements of the Islamic value system will come into direct conflict with recent and possible future developments in reproductive biology. By surveying the whole area of reproductive technologies, I hope to be able to identify the dangers inherent in recent developments in this field of knowledge for Muslim societies and raise ethical questions which need urgent attention by Muslim scholars.

Sexual attitudes – East and West

Human reproduction has invariably been controlled and regulated by a given set of sexual attitudes and the status of women in society. Traditionally, Muslims have taken a very open attitude to sex: within the bounds of marriage, it is to be encouraged wholeheartedly. '*Azl* (barrier methods of contraception), one of the most ancient contraceptive practices, was not unknown in pre-Islamic Arabia. There is undisputed evidence in the *Hadith* literature that the Prophet Mohammad did not declare it *haram* (forbidden). Thus Muslims had knowledge of and practised contraception since the early days of Islam. However, nothing but curiosity is aroused to note that in the West 'the Church of England remained officially opposed to contraception until the Lambeth Conference of 1930, and the BBC did not permit any direct reference to the work of the Family Planning Association until as late as 1950.'[1] And in the United States 'before 1938 it was illegal – even for physicians – to import, mail, or prescribe birth control devices.'[2]

The ambiguous sexual attitude of the West is perhaps a reflection of the hostility toward physical pleasure as it was developed by neo-Platonists and neo-Pythagorians. The religious tradition of the West did much to reinforce the sex-negating precepts.[3] There is an obvious mark of protest against the Church carried by the advocates of 'sexual preference'

– lesbians, radical feminists, male homosexuals, transvestites. Whatever may be the historical undercurrents of the Western sexuality, the present biomedical research in human sexuality and human reproduction stand poised against the 'traditional' moral order – it seems so.

One of the important questions surrounding the sexual attitudes is: sex for creation or recreation? According to Lewinsohn, a Paleolithic bone-engraving from the cave of Isturitz (in southwestern France) shows an erotic caricature 'which also indicates that love-life in the Stone Age was completely respectable ... here is no violence, no licentiousness – rather a comically exaggerated adoration of the female form'.[4] Still more interesting observation of the author about Paleolithic pictures of women is 'their complete concentration on the sex aspect as distinct from the reproductive. Many of the women, indeed, look as though they were pregnant, but no single representation of a mother and child, no "Madonna", has survived from this epoch.'[5]

Whether this 'free' attitude of the Stone Age represented a 'matriarchy', or whether no such attitudinal differentiation was possible at that time, is a question still contested among social biologists, anthropologists[6] and radical feminists – the latter ever confused in the semantics of the *first*[7] or the *second*[8] sex. Nonetheless, Genesis held Eve responsible for leading Adam astray for she incited him to commit the 'original sin'. The 'forbidden fruit' thus became a symbol of her aggressive sexual drive in subsequent mythology. Following the destruction of Sodom and Gomorrah, according to Genesis 19:30–38, it was Lot's daughter who led him into an incestuous relationship – for procreation?

Among the Hebrews, sex was an instrument for the propagation of family lineage and Hebrew people. Throughout Jewish history husbands have exercised full control over their wives; in addition, they could take concubines or associate with whores. Divorce was an unquestionable authority vested in *him*. Westermarck[9] believes that the right of the husband to repudiate his wife must be considered as central in Jewish thought, and this right has never been abolished in spite of a few restrictions imposed by rabbis. Temple prostitution had religious sanction and remained under religious supervision.

In the Hebrew tradition, women existed solely to serve men. Orthodox Judaism spread the word that women have no soul (a forerunner of witchhunt in Christendom), and the Jewish prayer of thanksgiving included these words: 'Blessed art thou, Lord, that thou hast not made me a woman.' The birth of a daughter was strongly despised as suggested by the following excerpt from the Talmud:[10]

> A daughter is a vain treasure to her father. From anxiety about her he does not sleep at night; during her early years lest she be seduced, in her

adolescence lest she go astray, in her marriageable years lest she does not find a husband, when she is married, lest she be childless, and when she is old lest she practise witchcraft.

The Pentateuchal Code (Leviticus 15:19) declared that *niddah* (a menstruating woman) shall be unclean for seven days from the beginning of the period, whether it lasts only one day or all seven.[11] In the wake of widespread violation of this taboo, the chief rabbi of Israel issued a statement in 1972 that recalls the punishment (*Karet*), the 'cutting of life on earth and the denial of a life to come'.[12]

Whitehurst *et al.* have summed up the Jewish situation in these words:[13]

> Throughout Jewish history men have unquestionably been in charge of women; recent information from Israel suggests that this pattern, although being questioned by the international force of the women's movement, has not been significantly altered. Rights of divorce remain essentially a male prerogative. Polygamy, prostitution, and concubines are a part of the Hebrew heritage to survive and fulfil their biblical destiny.

By and large, sexual attitude in Judaism has been one of affirmation, barring a few episodes in Jewish history when asceticism was glorified, such as in the case of the Essenes sect who denounced pleasure *per se* and declared that sexual pleasure is the most wicked of all.[14]

With the advent of Christianity, sexual activity became a sin. Virginity, chastity and celibacy were raised to a supreme spiritual position. Marriage was relegated to almost an animal ritual: one saint stated that 'the only justification for the horrifying sexual act was that it resulted in more virgins being born'. According to St Paul, the chief architect of Christianity, women were subordinate to men and primarily useful as household operatives or for the necessary evil: marriage. But celibacy was still a preferred status. St Clement stated that every woman should blush at the thought that she is a woman. In the eyes of St Thomas Aquinas, woman is a defective male, a misbegotten male. (It is very interesting to see how tables were turned when Elizabeth Davis, author of *The First Sex*, drawing on current genetic theories, stated that biologically it is the man who is a mutant of woman, 'the first males were mutants, freaks produced by some damage to the genes . . .'.[15])

Echoing Orthodox Judaism, a bishop proposed in 585 CE, that women were not only sinful and vicious *per se*, but did not even have a soul. Many Christian sects believed that sex and marriage were the inventions of the devil. The Council in Rome declared in 1703 CE, that sex between priests and women was whoredom. Bullough has commented that the

attitude of the Western medieval church was that sexual enjoyment was essentially meant for sinners. Celibacy was highly prized but those who could not adopt it were permitted to marry, with sexual intercourse directed toward generative ends only. Technically speaking, prostitution was permitted because of people's weakness, and sexual intercourse was 'part of God's way'.[16]

Relegated to chattels, women were forced to wear metal 'chastity belts', to guard the entrances to vagina and rectum. In Speert's view, 'A probable forerunner of these devices in the form of a pudendal shield called *kumaz* is mentioned in the Bible (Exodus 35:32 and Numbers 31:50)', and 'as recently as 1933 the League of Awakened Magyars advocated ... that all unmarried Hungarian girls of age 12 or older be required to wear a chastity girdle, the father or other competent authority maintaining custody of the key'.[17]

Negation of pleasure, or, for that matter, sexual pleasure sought numerous other outlets, in their way brutalising women. For instance, clitoridectomy (surgical removal of the clitoris) is traced to Gyges the Lydian, although, Jews are known to have practised it till 1000 CE. Emphasis on female virginity reached such unprecedented heights in Europe that in addition to chastity belts, female infibulation was practised. The hymen became so important that brides were subjected to physical examination before being accepted for marriage. In the midst of it all, there were some voices for reform, such as Martin Luther, who, at the age of forty, denounced celibacy but advised that sexual intercourse be restricted to twice a week only.

In Christendom, the drive for celibacy and virginity was not at all a peaceful venture: it claimed innumerable female lives under the banner of 'witchcraft'. Rightly terming this 'gynocide', Dworkin has attempted to arrive at a cumulative figure for the European continent and the British Isles of 9 million women burnt at the stake, for 'witchcraft was a woman's crime'.[18] They practised witchcraft, it was alleged, under Satanic influences, to bewitch males to their carnal desires. *Malleus Maleficarum*, the book of the 'holy' inquisition, termed women imperfect animals, naturally fickle, deceivers, who, in the lusts of the flesh, are easily led by the devil into becoming witches.

During the last half of the nineteenth century, Western sexual moves were dominated by Victorianism and Puritanism, albeit with certain subtle differences.

> Where the Victorians wished that women did not have vaginas and hoped that if they stopped talking about sex it would go away, the Puritans understood how men and women actually did behave ... They fully acknowledged that the flesh of both sexes was weak.[19]

With the dawn of twentieth century, the proponents of psychoanalysis emerged with the stamp of scientific authenticity. The Freudian school of thought projected women as castrated beings ('penis envy') desirous of rape by their fathers. As if this female 'castration' was not enough, the brutal practice of clitoridectomy was revived in a very subtle way: the clitoral seat of orgasmic pleasure in females was completely rejected in favour of vaginal pleasure. Was this too an echo of the Greek dualism – for Aristotle had said that if the clitoris was the seat of pleasure in women then away with it?

In much of the Western world, perhaps as a corollary of this Freudian intellectual heritage, the criminal justice system still holds woman a willing party to the heinous crime of rape – for she 'seduces'. As recently as 1969, a young woman in France was tried and convicted for the 'crime of seduction' of a young man. And in the same country, women did not earn the freedom to open bank accounts or to have a passport for themselves when married, till late 1950, only a year after they got voting rights![20]

The moral dilemma in human sexual relations and human reproduction as faced by Western society has no parallel in Islamic history. Compared with the Judaeo-Christian record on human sexuality, Islamic history presents a sex-positive attitude, regulation of matrimonial affairs in a more realistic style, recognition of sexual pleasure within the confines of marital relations, condemnation of celibacy, emphasis on congenial and loving family relations, and due recognition of women as individual human beings in all walks of life.

The ambiguity in human relations and the false consciousness that continue to victimise women in the Western culture are unknown in Islamic history. Recognising the innate biological/sexual make-up of human males and females, Islam established a balanced and just moral order which accommodated both sexual pleasure and procreation within the bounds of matrimony. It promulgated no double standards. Qur'ān made no mention of chastity belts nor were women accused of harbouring insatiable sexual desires under devilish influences.

Islam does not condemn woman as the seductive cause of man's downfall, nor does it make any reference to Eve's being created from Adam's rib. Man and woman were created by God:[21]

> And among His wonders is this: He creates for you mates out of your own kind, so that you might incline towards them, and He engenders love and tenderness between you: in this, behold, there are messages indeed for people who think.
>
> (*Ar-Rūm* (30):21.)

O mankind! Be conscious of your Sustainer, who has created you out

of one living entity, and out of it created its mate, and out of the two spread abroad a multitude of men and women.

(*An-Nisā* (4):1.)

The role of woman, like that of man, was declared to be a servant of God. Thus, morality and chastity were proclaimed to be *human* obligations and not sex-specific functions:

Verily, for all men and women who have surrendered themselves unto God, and all believing men and believing women, and all truly devout men and truly devout women, and all men and women who are true to their word, and all men and women who are patient in adversity, and all men and women who humble themselves (before God), and all men and women who give in charity, and all self-denying men and self-denying women, and all men and women who are mindful of their chastity, and all men and women who remember God unceasingly: for (all of) them has God readied forgiveness of sins and a mighty reward.

(*Al-Aḥzāb* (33):35.)

Clearly, this Qur'ānic code of human conduct establishes an equal and just arena for actions by males and females alike. Without any sexual bias, the emphasis is on action – on just action:

O you who have attained to faith! Be ever steadfast in upholding equity, bearing witness to the truth for the sake of God, even though it is against your own selves or your parents or kinsfolk. Whether the person concerned be rich or poor, God's claim takes precedence over (the claims of) either of them. Do not, then, follow your own desires, lest you swerve from justice; for if you distort (the truth), behold, God is indeed aware of all that you do.

(*An-Nisā'* (4):135.)

Qur'ānic legislation and the *Sunnah* (the way) of the Prophet Mohammad do not carry any slant toward sex, race or colour.

Recognition of innate biological pleasure was not intended to be a licence for lewdness, thus, men and women alike were commanded to be chaste and modest:

Tell the believing men to lower their gaze and to be mindful of their chastity: this will be most conducive to their purity – (and,) verily, God is aware of all that they do. And tell the believing women to lower their gaze and to be mindful of their chastity, and not to display their charms (in public) beyond what may (decently) be apparent thereof.

(*An-Nūr* (24):30–31.)

The restrained gaze demanded of men and women alike must be understood in terms of physical modesty as well as restraining the sexual urge

– that is, both physical and emotional modesty. In accordance with the Qur'ānic principles of social morality, this pleasure must be confined to lawful marital intercourse.

Yet another recognition in male–female relations was that of biological role differentiation. Obviously, men and women are not alike biologically. This difference is much more pronounced in their respective reproductive apparatus than any other physical part. It, therefore, follows that some of their behavioural traits will be governed at least by the dictates of their biology. Thus, a denial of contribution of biology to the shaping of human behaviour would be tantamount to the denial of *human biology* itself. Islam provided an elaborate legislation in this area ranging from rights and responsibilities of wife and husband to the rearing of children. For instance, fasting is obligatory upon Muslim men and women, but menstruating women or those engaged in childbirth are not permitted to do so. This illustrates that Islam not only recognised the biological role differentiation but circumscribed those actions which would conform to such a differentiation between males and females.

Islam declared marriage to be the only legal course of interaction between males and females. Within marriage, peace, love and mercy were to be exercised among partners who would be guided by *taqwā* (God-consciousness) alone. Marriage was institutionalised as a starting point of family and procreation was encouraged. Marriage entailed certain responsibilities and it was enjoined upon those who are capable of fulfilling their obligations, sexual, financial as well as spiritual. For instance, a Muslim has the right to ask for divorce if her husband is sexually impotent, illustrating the role of sex in marriage as well as acknowledging female sexual pleasure in conjugal relations.

Without defining the parameters of sexual 'equality', it is alleged by some Western scholars that Muslim women have been given into male bondage by virtue of the following Qur'ānic statement:

> Men shall take full care of women with the bounties which God has bestowed more abundantly on the former than on the latter, and with what they may spend out of their possessions. And the righteous women are the truly devout ones, who guard the intimacy which God has (ordained to be) guarded.
>
> (*An-Nisā'* (4):34.)

It is charged that 'men are a degree above women' and that is so because of her sex. The above Qur'ānic statement must be viewed in the light of biological role differentiation and what it entails. '... which God has bestowed more abundantly on the former than on the latter' implies the biological attributes of manhood, by virtue of those he performs an instrumental function in the family: protection, maintenance, leadership

etc. If the above Qur'ānic statement is interpreted to mean the male subjugation of female for the 'curse' of her sex, it contravenes the overriding spirit of the Qur'ān as we have noted on previous pages. The Qur'ān makes it abundantly clear that males and females are subject to a just order: they are rewarded alike, they are punished alike:

> And thus does their Sustainer answer their prayer: 'I shall not lose sight of the labour of any of you who labours (in My way), be it man or woman: each of you is an issue of the other.
>
> (Āl-'*Imrān* (3):195.)

Polygamy is not sanctioned in Islam. Muslim marriage signifies conjugal love and these highly subjective feelings are not amenable to a quantity of two, three or four – as it is explicitly stated:

> And if you have reason to fear that you might not act equitably towards orphans, then marry from among (other) women such as are lawful to you – (even) two, or three, or four: but if you have reason to fear that you might not be able to treat them with equal fairness, then (only) one.
>
> (*An-Nisā'* (4):3.)

> And it will not be within your power to treat your wives with equal fairness, however much you may desire it; and so, do not allow yourselves to incline towards one to the exclusion of the other, leaving her in a state, as it were, of having and not having a husband.
>
> (*An-Nisā'* (4):129.)

Those who do practise plural marriages under any pretext do so in clear contravention of the Qur'ānic statement. That the above statement in the Qur'ān related to males alone and nothing was said of whether women may contract more than one male is commented upon by Muḥammad Asad:[22]

> Notwithstanding the spiritual factor of *love* which influences the relations between man and woman, the determinant biological reason for the sexual urge is, in both sexes, procreation: and whereas a woman can, at one time, conceive a child from one man only and has to carry it for nine months before she can conceive another, a man can beget a child every time he cohabits with a woman. Thus, while nature would have been merely wasteful if it had produced polygamous instinct in woman, man's polygamous inclination is biologically justified. It is, of course, obvious that the biological factor is only one – and by no means always the most important – of the aspect of maternal love: nonetheless, it is a basic factor and, therefore, decisive in the institution of marriage as such.

Some recent books have tried to project the issue of clitoridectomy as indigenously Muslim, alleging that the practice of female genital mutilation by removal of the clitoris or vaginal infibulation is sanctioned by Islam.[23] This is absurd. There is no such injunction in the Qur'ān or the *Sunnah* of the Beloved Prophet. Reviewing the geographical locations where it is most practised, one comes across the tribal regions of West Africa or sub-Saharan Africa. In Egypt, it has been known since the time of the Pharaohs. And if the Sudanese statement that it is practised to control the excessive sexual urges in females is quoted right, it is reminiscent of the Western attitudes to female sexuality. There are no known cases of this practice in Algeria, Libya, Morocco or Tunisia. Muslims in Pakistan do not resort to this practice, nor do millions of those who live in China or USSR. There have been a few isolated reports from the rest of the Arab countries. However, Egypt is known to have outlawed the practice in the early 1950s.

Mutilation of female psyche is embedded deeply in the sexual attitude as developed in the Western myth and folklore. Menstruation is a case in point. For centuries Western culture perceived menstruation as a horrifying function and an evil. Since woman is evil thus from her evil all evil flows:[24]

> The menstruous woman is possessed by an evil spirit; the spirit resides in her blood, and by the medium of her menstrual blood may exert its influence, for good or harm, on her environment. The evil spirit may effect its entry into the woman in the form of a bird, or a lizard or a serpent; hence the folk association of these animals with menstruation. It was the serpent that marred primordial bliss of Eden.

And Weideger has stated:[25]

> The most damning euphemism attached to menstruation reflects the belief that the monthly flow of blood is the curse of God laid upon woman for her sin in Eden.

Menstrual prohibition in Islam is no reflection on female psyche. Instead, the Qur'ān used the word 'flow' 'which was selected, apart from other terms used by Arabs bearing the meanings of toxicity or uncleanness. The term points to the "time", the "site" and the "act", denoting that it is harmful. Thus the prohibition, in Islam, is limited to avoidance of coitus at that particular time of the flow.'[26]

> And they will ask thee about (woman's) monthly courses. Say: 'It is a vulnerable condition. Keep, therefore, aloof from women during their monthly courses, and do not draw near unto them until they are

> cleansed; and when they are cleansed, go in unto them as God has bidden you to do.
>
> (*Al-Baqarah* (2):222.)

We have seen how Islam resolved the moral dilemma 'sex for creation or recreation' that has plagued Western culture for thousands of years and in its wake claimed innumerable women's lives, erected false notions on human female psyche, repressed genuine sexual expression, and outlawed a harmonious relationship between man and woman. The Islamic concept of human sexuality and human reproduction brought about a resolution of these conflicting situations by recognising male and female as equal partners in life, legitimising marital sexual congress, endorsing female sexuality in positive terms, encouraging human reproduction conceived in purity, and recognising biological role differentiation with concomitant social behaviour, and postulating that 'a spiritual relationship between man and woman is the indispensable basis of sexual relations'.[27]

> Your wives are your tilth; go, then, unto your tilth as you may desire, but first provide, something for your souls, and remain conscious of God.
>
> (*Al-Baqarah* (2):223.)

Some recent spectacular and not so spectacular advances in biomedical research have produced an array of products and processes which have a direct bearing on the nature of sexual congress, its physical and emotional attributes, its end products, and, above all, on human sexual behaviour and its conformity with the established moral order. In the next few pages, we will attempt to construct a Muslim response to these biomedical advances, drawn upon and elaborated from the ideological precepts of Muslim sexual ethics.

Reproductive technologies

For the purpose of the present discussion, the term 'reproductive technologies' alludes to all those human interventions – physical, mechanical, chemical, social or otherwise – that are attempted during the following stages of human reproduction:

1. *Pre-conception*, inclusive of '*Azl*, prophylactic condoms, contraceptive jellies/foams/creams (spermicides), vasectomy, tubal ligation, oral contraceptive pills.
2. *Post-conception*, inclusive of therapeutic and induced abortion, intra-uterine devices (IUDs), amniocentesis, sexual selection.
3. *Pro-conception*, inclusive of artificial insemination, *in vitro* fertilisation (IVF), sterility and infertility, biological and social parenthood.
4. *Eugenics*, inclusive of recombinant DNA (rDNA), cloning.

The discussion will be limited to the above products and processes in the context of their basic operational features, and issues such as fertility regulation and its socio-economic aspects, though akin to the subject, will be excluded.

'Azl (*coitus interruptus*)

We have already noted that *'Azl* was not declared ḥarām by the Prophet Mohammad. According to Jalāl ad-Dīn as-Suyūṭī (born in Egypt 848/1445), two contraceptive methods were in vogue during the days of the Prophet: (i) *al-'Azal*, and (ii) *al-Ghayl* (coitus with a lactating woman). An authentic tradition attributed to one of the companions of Prophet Muhammad states:

> We used to have recourse to *'Azl* in the Prophet's age. He came to know of it but did not prevent us from doing so. If it were something to be prevented, the Qut'ān would have prohibited it.

However, the practice was neither forbidden nor explicitly allowed, but required the permission of the wife. Since there is every possibility of premature ejaculation during the act, Caliph 'Umar ibn al-Khattāb 'declared the child of a person as his legitimate child who practise *'Azl* with a slave woman'.[28] It can be readily discerned that contraception *per se* was not forbidden and that women's right to sexual pleasure was upheld. Concerning the permissibility of *'Azl*, Imām al-Ghazālī stated that the intention played a great role. He did not equate it with female infanticide or abortion since he argued that a child is not the product of male sperm alone. It is interesting to note that Onan, son of Judah, practised *coitus interruptus* with Tamar (Genesis 38:9) and perhaps this is why 'Onanism' became synonymous with masturbation – the 'sin of Onan', for he let his seed fall on the ground.

Coitus with a lactating woman (*al-Ghayl*) was also a contraceptive method effective to a limited extent. It was even equated with 'secret infanticide', for if conception did take place, the child at the mother's breast would be deprived of his/her share. Clearly, the emphasis on child welfare was upheld.

The practice of female infanticide in pre-Islamic Arabia, whether motivated by economic hardship or the 'guilt' of having a daughter, was prohibited in Islam:

> And do not kill your children for fear of poverty – (for) it is We who shall provide sustenance for you as well as for them . . . and do not take any human being's life – (the life) which God has declared to be sacred – otherwise than in (the pursuit of) justice.
>
> (*Al-An'ām* (6):151.)

> And when the girl-child that was buried alive is made to ask for what crime she had been slain.
>
> (*At-Takwīr* (81):8–9.)

Prophet Mohammad had said:

> Whoever is blessed with two daughters or is taking charge of two sisters, and treats them well and patiently, he and I shall be in Paradise like these . . . (the index and the middle finger side by side).

The evidence for the practice of *'Azl* and *al-Ghayl* appears to support the following conclusions:

1 Human life is sacred.
2 Contraception is neither prohibited nor encouraged except in the context of intention – e.g., fear of economic suffrage or the sexually biased *guilt*.
3 Mutual marital sexual pleasure ought not to be sacrificed at the altar of contraception.
4 Child welfare must be preferred over contraception.
5 Contraceptive practices which preclude the union of male and female gametes are not tantamount to 'killing'.
6 Attempt to enforce a sexual selection motivated by a gender bias is prohibited.

Prophylactic condoms, spermicides, vasectomy, tubal ligation, contraceptive pills

At the 'pre-conception stage', the currently available reproductive technologies are utilised for the prevention of gametic union, principally by three means: (i) Mechanical (prophylactic condoms or caps); (ii) Chemical (spermicides, such as jellies, foams or creams, and oral contraceptive pills); and (iii) Surgical (vasectomy in men and tubal ligation in women). Like *'Azl*, these contraceptive methods are not all without the risk of an 'unwanted' pregnancy. Furthermore, some of these technologies have been shown to have produced harmful side effects, and the occurrence of ovarian cysts and ovarian cancer has been linked to the use of oral contraceptive pills though this has not been proved. Spermicides, though discreetly manufactured to be colourless/odourless, are known to have produced mild allergic reactions or local irritations. In the case of surgical intervention, both vasectomy and tubal ligation have a hundred per cent record of success in preventing fertilisation. However, the psychological effects of sterility in both men and women, problems of resumption of normal function, and ovulatory disorders are not uncommon.

Do all these 'modern' reproductive technologies represent an *improved* form of *'Azl*? It appears so, in so far as the mechanics are concerned – all

of them, either by mechano-chemical or surgical means, attempt to prevent conception. Should these technologies then be viewed the same as *'Azl*? The answer is negative. They differ in a number of ways. For instance, prophylactic condoms and spermicides introduce a 'foreign' element into coitus which may reduce mutual sexual pleasure. Oral contraceptive pills have a good record of success but carry certain health risks and may also impair the woman's emotional health. Vasectomy and tubal ligation also carry some risks. In the case of *'Azl*, the success rate is inferior to pills but no physical/chemical risk is involved.

But the question that looms largest is whether these technologies have, because of their ready availability, served as instruments of the so-called 'sexual revolution' of the 1960s? And to what extent have they contributed to the breakdown of moral order, increased licentiousness and promiscuity? A plain argument would not endorse these technologies simply to reduce the numbers of teenage pregnancies. It is *not* a problem of lack of sexual knowledge. Rather it is a problem of amoral sexual conduct.

Therapeutic and induced abortion

Current debate in the United States on the 'Human Life Amendment' might make one believe that abortion is a 'modern' phenomenon. However, mankind has resorted to this practice for ages: Devereux has tabulated extensive data on four hundred preindustrial societies who employed various abortive techniques for the termination of pregnancy.[29] What is new in the old debate on abortion is apparent from the text of the proposed Human Life Amendment: 'The paramount right to life is vested in each human being from the moment of fertilisation without regard to age, health or condition of dependency'. Of course, in the echelons of the 'Equal Rights Amendment', feminists have understood this to be the grant of constitutional protection to fertilised eggs, as well as the resurgence of the catchword: 'Biology is Destiny'. Nevertheless, the issue of abortion deserves much more than a political debate among power groups.

We have observed that Islam prohibits taking any human being's life except in genuine self-defence or in cases of imposed aggression, such as war. It explicitly prohibits infanticide for any reason whatever. So the first question to be addressed in any debate on abortion is: When does *life* begin? Because it is *life* which confers the status of *human being* upon the fertilised egg. In other words, at what stage in its embryological development does the zygote assume the attributes of a human being to the extent that an abortion would equal a premeditated murder? This question has not been easy to answer. Biological information on foetal development heavily influences our judgement in establishing the criteria for absolving the practice of abortion from the stigma of murder.

An account of the beginning of human life, according to the Qur'ān, reads:

> Now, indeed, We create man out of the essence of clay, and then We cause him to remain as a drop of sperm in (the womb's) firm keeping, and then We create out of the drop of sperm a germ-cell, and then We create out of the germ-cell an embryonic lump, and then We create within the embryonic lump bones, and then We clothe the bones with flesh - and then We bring (all) this into being as a new creation: hallowed, therefore, is God, the best of artisans.
>
> (*Al-Mu'minūn* (23):12–14.)

Is this not an accurate description of what we have learnt from hundreds of years of biological research?

The first Qur'ānic revelation to the Prophet Mohammad proclaimed:

> Read in the name of thy Sustainer, who has created - created man out of a germ-cell! Read - for thy Sustainer is the Most Bountiful One who has taught (man) the use of the pen - taught man what he did not know.
>
> (*Al-'Alaq* (96):1–5.)

It is appropriate to refer to some of the observations of Ḥussain, who has tried to correlate the various lexical meanings of the word *al-'Alaq* (which is the name of the *Sūrah* as well) with our knowledge of the stages in early foetal development. The author has attempted an allegorical description of *al-'Alaq* to be the stage 'occupying the period of development of the zygote, from the eighth day to the twenty fourth day after fertilization'.[30] He has also observed:[31]

> The first revelation which came to Prophet Muhammad (peace be upon him), mentions the stage of *Alaqa* which is very surprising, in view of the fact that *Alaqa* is a mid-stage in the development of the embryo and not the first. The question arises that, in this verse, instead of mentioning the semen or some other stage like dust, why '*Alaqa*' is specially mentioned.

In his opinion, the Qur'ān alludes to the art of reading (*Iqrā'*), the faculty of learning (*'Allama*), and the art of writing (*Qalam*) in this *Sūrah* to emphasise their relation with '*Alaqa* for all these 'higher functions are dependent upon the nervous system which surprisingly appears in its primitive form as a streak, at this stage of *'Alaqa*, on the eighteenth day after fertilization'.[32]

The discussion on the Islamic conception of 'life' cannot stay limited to the organic manifestations alone, for the Qur'ān makes frequent references to *Nafs* (soul) and *Rūḥ* (spirit) when alluding to living beings. *Nafs* (with

its plural *Anfūs* and *Nufūs*) has been used in the Qur'ān in five different categories as mentioned by Mājid 'Alī Khān:[33]

1 In most cases they mean the human self or person, *Al-'Imrān* (3):61; *Yūsuf* (12):54.
2 In six verses *Nafs* refers to God, *Al-'Imrān* (3):28, 30; *Al-Mā'idah* (5):119; *Al-An'ām* (6):12, 54; and Ṭā Hā (20):41.
3 At two places it refers to gods, *Al-Furqān* (25):3.
4 In *Al-An'ā*m (6):130, the plural *Anfūs* is referred twice for the company of men and *Jin*.
5 At several places it is also used for human soul, *Al-An'ām* (6):93; *At-Taghābun* (64):16; *Al-Ḥashr* (59):9; *An-Nāzi'āt* (79):40. This soul (*Nafs*) has three characteristics: (a) it is *ammāra* i.e., commanding to evil, *Yūsuf* (12):53; (b) it is *lawwāma* i.e., it upbraids, *Al-Qiyāmah* (75):2; and (c) it is addressed as *muṭma'inna* i.e. tranquil, *Al-Fajr* (89):27.

The word *Rūḥ* has been used in the following five senses:

1 God blew (*nafakha*) of His *Rūḥ* into Adam, *Al-Ḥijr* (15):29. It is also described that He blew His *Rūḥ* into Maryam for the conception of 'Īsa, *Al-Anbiyā'* (21):91.
Here *Rūḥ* has been equated with *Rīḥ* and means 'breath of life'.
2 Four verses connect *Rūḥ* with the command of God but different theologians explain it in different ways: *Rūḥ* is connected with knowledge, *Al-Isrā'* (17):85; with angels, *Al-Naḥl* (16):2; with creatures of warning, *Ghāfir* (40):15; and in connection with the Prophet Mohammad for knowledge, faith, light and guidance.
3 At one place 'Īsa is called a *Rūḥ* from God, *At-Tawbah* (9):171.
4 It is used as an associate of the angels. Most of the commentators regard this spirit as Jibra'īl, the angel of inspiration, *Al-Qadr* (97):4; *An-Nabā* (78):38.
5 In *Ash-Shu'arā* (26):193, Jibra'īl is named as *Rūḥ al-Amīn*. It is referred in the sense of an angel sent to Maryam, *Maryam* (19):17; the term *Rūḥ al-Quds* is used for the angel Jibra'īl, *An-Naḥl* (16):102. Three other verses state that God helps 'Īsa with *Rūḥ al-Quda*, *Al-Baqarah* (2):87 and 253; *Al-Mā'idah* (5):119.

From these Qur'ānic references inference is drawn that living being is not an organic entity alone, explainable and expandable in strict physiochemical terms or molecular hierarchies. Many commentators of the Qur'ān have devoted their discourses on the pivotal subject of *Nafs* and *Rū. h*, and, out of exigency, have attempted a definition by way of their understanding of death – opposite of life. The consensus appears to be that at death *Rūḥ* is permanently and completely severed from the body

though it does not die itself, it is the *Nafs* that death extinguishes and bodily functions come to a halt.

Moving from this stage, and extrapolating the meanings that in the process of organic creation (as noted in the Qur'ān (*Al-Mu'minūn* (23):12–14), *Rūḥ* is infused into the Nafs at the moment when God 'brings all this into being as a new creation', it is obvious that a precise establishment of the time or the stage corresponding to the foetal development in question cannot be made!

What then of the Muslim response to the challenge of abortion? Would it be ḥalāl for a Muslim to terminate a pregnancy before the foetus reaches the stage that approximates what has been pointed out in reference to the creation of *Nafs* and *Rūḥ*?

Throughout Muslim history, abortion has been resorted to, both as a therapeutic agent or an induced activity. Regarding therapeutic agency, there is a unanimous verdict of Muslim jurists that it is lawful to abort the foetus if the mother's life is threatened by continued pregnancy for it is better to save one life than to destroy two. In the case of induced abortion (when there is no apparent threat to the health of the mother), opinions differ.

Some Muslim jurists, basing their opinion on a *Ḥadīth* that *Rūḥ* is breathed into the foetus after 120 days of fertilisation, permit termination of pregnancy – obviously endorsing induced abortion. The permissibility of abortion within a period of 120 days is attributed to the Ḥanafī school of law. However, Muḥammad 'Abdul Raūf argues that the majority of jurists reject the Ḥadīth itself which is the basis of the above Ḥanafī verdict.[34] On the other hand, Maḥmūd Zayid has stated:[35]

> With regard to the question of induced abortion, Muslim scholars both classical and modern make a distinction between two stages in the pregnancy divided by the end of the fourth month (120 days), with all holding the view that abortion should not take place during the second stage. Classical views, as expressed by scholars of the four *Sunni* (orthodox) schools and of the dissident Shi'ite and Kharijite sects, on induced abortion before the end of the first four months of pregnancy, fall into four basic categories: unqualified allowance without the need of an excuse; permissibility if there is an excuse and disfavour if there is not; unqualified disfavour in all cases; prohibition in all cases.

Furthermore,[36]

> The credit must go to the Rabat Conference for providing the first clear and quite humanistic definition of the excuse for induced abortion as *the extreme personal necessity, in order to safeguard the life of the mother, or in the case of there being no hope for the life of the foetus.*

However, without such an excuse, induced abortion after the first four months or pregnancy is prohibited.

The above mentioned 'quite humanistic definition' of induced abortion fails, however, to explicate the 'extreme personal necessity'. Should it be understood in terms of absolute freedom to women in the use of their own bodies? Should the foetus be granted the status of a woman's personal property that she can dispose of at will? If so, what happens to Muslim moral order which is at once individual and collective? This stands in dire contrast to the Western tradition where *morality* is either a matter of 'privacy' or 'alternative life style'.

The organic beginning of life in the mother's womb, it would appear, is not so much at the heart of the abortion issue as the problem of attributing or assigning a set of values to the rapidly growing blob inside the uterus. It is clear that ever-improving foetal diagnostic technology would give us a better insight into the physical mysteries of human growth. The possibility of detecting foetal heartbeat and brain activity by the use of electrophysiologic and echographic instruments within the first eight to twelve weeks indicates that further progress could become more revealing. This initial eight to twelve weeks of foetal development fall within the 'permissible' clause of 120 days.

It can be argued that the biological viability of the foetus at such an early stage of development is totally dependent upon its uterine environment. However, the current trend of research in human *in vitro* fertilisation means that the perfection of techniques for extra-uterine development is only a matter of time. Should the uterus then be considered nothing but a human petri dish? In nature, spontaneous abortion is a common occurrence: nearly 70 per cent of embryos are spontaneously aborted.[37] Naturally then nothing appears to be abnormal with abortion.

The Muslim juristic consideration of the stages of foetal development in the context of 'permissibility' of abortion carries at least one important implication, namely, that it is not the flesh and bone structure taking shape in the uterus that should serve as the green light for abortion but a value-structure bestowed upon the growing individual that should establish the criterion for abortion or otherwise. From this standpoint, it could be surmised that the Muslim juristic opinion confers a value-structure to the developing foetus at a certain stage of its life and that conferment is understood to be the moment when the *Nafs* and the *Rūḥ* are supposed to have integrated as a whole being. Further, the 'permissibility' clause is applicable in the case of induced abortion, while, rightly so, this clause is not time-barred in case of therapeutic abortion. 'Extreme personal necessity', therefore, must conform to the Muslim moral order which regulates sexual conduct strictly within the confines of marital bonds. The

catch-phrases 'reproductive freedom' or 'woman's own body' are but the reflectors of a socially alienating philosophy *free* from moral responsibility. Apart from *bona fide* motives for induced abortion, such as rape or incestuous attacks, the feminist critique of the 'pro-life' group is, by implication, an invitation to illicit sex.

From the moment of conception till the so-called age of 'consenting adults', human life undergoes both physiological and emotional changes. It is in rapid flux, continuous change. Relative to the age in development, both biological and social values are either imbibed by or imposed upon the individual. These biosocial realities of human development are well accepted and most of our social laws are directed toward a specific age-related behaviour of the individuals. Why then should the uterine phase of human development be excluded from such a social regulation? Why should it not be seen as part of a continuum? It is irrelevant to ask as to *when* life begins – what is at stake in the abortion debate is *when* life ends and under what pretext? Abortion prohibition applies not to a physico-chemical structure but to a moral order which precludes extreme personal necessity.

The sanctity of human life is upheld by Islam not only in its moral context (i.e. preemptive prohibition of illicit sexual relations) but in all its social ramifications. Islamic jurisprudence recognises the foetal 'right to life' to the extent that the foetus has the right of legal inheritance and if it is aborted alive, a monetary ransom becomes payable.

The foregoing discussion on abortion issue makes it self-evident that Islamic jurisprudence is committed to the defence of 'right to life' in its moral as well as its social context. However, it does not permit the perpetuation of an egotistic, lustful, licentious lifestyle that transgresses the foetal 'right to life' for the sake of transient sexual pleasure. Reproductive freedom, therefore, is not a question of extreme personal necessity but the hallmark of sharing the moral and social responsibility in a familial milieu regulated by Muslim code of conduct. The foetal 'right to life', according to what can be understood from the Islamic jurisprudence, originates not exclusively from its role as a distinct biological entity but from the recognition of an integrated whole comprised both of biology and spirituality.

The subject of abortion and issues surrounding the current debate such as definition of life and right to life are indeed complex and in need of further deliberations by Muslim jurists in the light of modern biomedical research. It is lamentable that the First International Conference on Islamic Medicine (Kuwait, Rabī' al-Awwal, 1401/January 1981) that unanimously adopted the *Islamic Code of Medical Ethics* paid little attention to this subject or other related issues, except for a brief mention of the prohibition.[38]

Intra-uterine devices (IUDs)

Intra-uterine devices are usually made of metal or plastic, often coated with copper or containing a hormonal component. They are placed inside the uterus by a simple gynaecological procedure. IUDs differ from the various products and processes mentioned in the context of the pre-conception group in that they prevent implantation of the fertilised egg. It is not precisely known how the IUDs work inside the uterus in preventing implantation. This mechanical and/or chemical interference raises serious questions about its permissibility as a contraceptive device. Recalling our basic premise that the group of certain reproductive technologies which are employed to prevent the male and female gametic union have a tacit approval for their use, IUDs should be classified as a 'miniature' abortion. Since the uterine implantation of the fertilised egg is a matter of the first week of conception, the use of IUDs falls within the 120 day limit as enunciated by the 'permissibility' clause. However, it differs from induced abortion in the sense that the latter is a solitary activity pursuant to a single detectable pregnancy, whereas continued use of IUDs implies rather a continuous occurrence of these 'miniature' abortions. Further, the continued use of IUDs has been linked to heavy and painful menstrual flow, uterine perforation, and ovarian infections.

Amniocentesis, sexual selection

Amniocentesis is one of the foetal diagnostic techniques involving an analysis of the amniotic fluid from a pregnant woman. This analysis, when coupled with a battery of sophisticated diagnostic tools, such as chromosome analysis, gene mapping, radio-immunobiostasy etc., could be quite revealing about the status of the developing foetus. It could be utilised in the detection of certain genetic disorders or certain structural and metabolic malfunctions of the foetus. Islamic jurisprudence would permit the use of such biomedical instrumentation which in the case of foetal malformation, would attempt to improve the foetal quality of life either by correcting any congenital disorder or enhancing foetal viability. However, two different aspects of foetal diagnostic tools come into play. It is possible that, based on the physiological and chemical data about the gender of the developing foetus, the decision is made to abort if it does not reveal the desired gender, usually male. This would be nothing but the age-old female infanticide as practised in pre-Islamic Arabia and prohibited by the Qur'ān. In addition to the Qur'ānic prohibition, we have also seen that a sexual selection which precludes either gender is not allowed in Islam.

The second perspective of the foetal diagnostic techniques is the decision to terminate pregnancy if a serious genetic disorder is detected in the foetus. This raises a complex set of questions on the Islamic concept

of the right to life as well as of the quality of life. The first concern would be the moment in foetal development when a genetic malfunction is detected. The second concern would be the severity of the genetic disorder in terms of foetal viability or post-natal survival and any possibility of applying *in utero* genetic therapy.

The ethical dilemma in aborting a genetically malformed foetus may perhaps be resolved by guidance from the juristic verdict on therapeutic abortion where it is permitted that the foetus may be aborted if it poses a threat to the mother's health, or abortion may be carried out in the face of an absolute medical necessity. Should a genetic disorder be regarded as such a medical necessity? If so, how is a reconciliation reached between this type of therapeutic abortion and the legal status of the foetus? Should this abortion be considered as mercy killing of the foetus? If so, mercy killing is not permitted in Islam!

Another complication relates to the process of amniocentesis itself. For instance, the stage of foetal development that may be utilised for such diagnostic purposes is usually past the first sixteen weeks or so. If a much more sensitive diagnostic technique becomes available wherein the detection of foetal genetic disorders is possible at a much earlier stage, should the malformed foetus be aborted – taken for granted the 120 day clause of 'permissibility' of abortion?

It would appear that in contrast to the therapeutic abortion, amniocentesis poses a peculiar problem of its own which shifts the emphasis from pregnant mother to developing foetus and the legal status of that individual. Added to this is the problem of future biosocial safety since the foetus is the carrier of an inheritable disorder.

Artificial insemination (AI)

This simple technique of placing sperm inside a woman's vagina was first successfully performed in 1790. In the early 1930s animal husbandry techniques were successfully employed in human clinical situations and by 1970 an estimated 200,000 Americans were reportedly conceived through this method. Since the time of a widespread use of AI, a number of ethical questions have been raised, with differing opinions. In 1962 the United Presbyterian Church of the United States approved its clinical use while a year later the New York State Supreme Court ruled that a child conceived through AID (insemination by donor) is illegitimate even if it was carried out with the husband's consent.[39]

Artificial insemination is necessitated under two conditions: primary impotence when the husband is not capable of depositing sperm during normal coitus, or sterility of the husband. In the first case, if the husband's sperm is biologically healthy, artificial insemination may be resorted to for the initiation of pregnancy. In case of aspermia and male sterility, a

donor's sperm is utilised in the process. Hence, AI is either by husband (AIH) or by donor (AID). Perhaps George Orwell's vision of a sinister society where artificial insemination would be mandatory by *1984* is borne out by the fact that AI seems to be on the verge of being mass marketed. Two commercial sperm banks in the United States process over two hundred orders monthly and a 'home insemination kit' (like the widely available 'early pregnancy test kit') may be in the offing![40]

Does artificial insemination infringe upon the sanctity of marriage? Should it be classified as one form of adultery? Is an AID child illegitimate? Does he/she have rights of legal inheritance? Conversely, as a curative measure, should AID be equated with normal blood transfusion, or, say, organ transplantation? These are some of the questions intimately associated with the practice.

In the case of AI involving the husband's sperm, there appears to be no injunction of the *Sharī'ah* which could be considered a bar to such a practice: there is no Muslim juristic verdict available. However, a Libyan law of 7 December 1972 amended the Libyan Penal Code by adding the following two articles:[41]

> Article 403/A, provides:
> Anyone who impregnates a woman by artificial insemination by force, threat, or deceit is to be punished by imprisonment not to exceed ten years, the punishment to be for a period of not more than five years if the insemination was with her consent.
>
> The second, Article 403/B, provides:
> A woman who consents to artificial insemination or who undertakes artificially to impregnate herself is to be punished with imprisonment not to exceed five years. The husband is punished with the same penalty as in the preceding paragraph if the insemination was with his consent, regardless of whether the insemination was performed by his wife or by another.

The prohibition against AIH is implicitly based on the premise that such a practice could be considered as an alteration of God's design of creation. This is apparently a failure on the part of the legislators to recognise that AIH may be necessitated by an organic disorder in the body of the husband – otherwise, there appears to be no logic in sacrificing mutual sexual intimacy for the sake of an AI adventure! On the other hand, as Mayer has pointed out,[42] the laws on paternity under which 'a child born to a woman during marriage – or within the periods of gestation as calculated by the various schools of law – is conclusively presumed to be the legitimate child of her husband ... [and] proof of non-access or blood tests do not overcome this presumption' make it

possible that the practice of artificial insemination may be abused by the wife, particularly when the maximum period of gestation is recognised (*vide* Mālikī *fiqh*) to be an unbelievable five to seven years!

Undoubtedly, it is the practice of AID which raises serious questions since it alters the basic organic structure of the family, introduces an outside component to the lineage and opens doors for abuse of the laws of paternity by getting into 'mail order' or 'over the counter' 'adultery'. It is this aspect of AI which needs further consideration.

The question of artificial insemination by an anonymous donor's sperm may be addressed from at least two important perspectives, namely, the Muslim concept of familial perpetuation, and the Muslim juristic viewpoint on adultery (*zinā*), the latter as an infringement upon the family lineage. 'Abd al-'Aṭī has observed:[43]

> Adoption, mutual alliance or clientage, private consent or access to sexual intercourse, and 'common law' or 'trial' marriages do not institute a family in Islam ... Islam seems to insist that the foundations of the family should rest on solid grounds capable of providing assurances of continuity, security and intimacy, and of being, as much as possible, 'natural', mutually binding, and gratifying. Accordingly, Islam recognizes only blood ties and/or marital bonds as the true foundations of the family. There is no more natural relationship than that of blood. Similarly, there is no more wholesome pattern of sexual relations than that which joins gratification with conscientiousness ... And it is this type of institutional and conscientious sexual relationship which Islam enjoins as a solid foundation of the family structure.

In the eyes of the Muslim legal postulates, lineage or paternity is considered legitimate in the case of progeny conceived during wedlock, the juristic verdict on the maximum period of gestation notwithstanding. Whereas the pre-Islamic societies linked the paternity or *nasab* exclusively with the father, Islam established *both* mother and father in legal conjugal relationship as the vital links in the lineage. It is, therefore, this crucial addition of the maternal link to the *nasab* that imparts a legitimate lineage.

It is from this perspective that the offence of *zinā* is considered as the 'gravest of offences which merits the gravest of punishment':[44]

> The issue of *zinā*, and only the issue of *zinā*, are illegitimate. They have no *nasab* and are outlaws. Sexual relations outside marriage, therefore, in the contemplation of Muslim jurisprudence can lead to only one result. They will create outlaws, or at least distort and confuse the lines of *nasab*. Hence they pose the greatest threat to the family law because they undermine its foundation.

Artificial insemination of a woman by the sperm of a donor who is not legally married to her, therefore, appears to distort the basic pattern of Muslim familial perpetuation simultaneously with a *zinā* by proxy, for the latter simulates the end product of a heterosexual intercourse barring any contraceptive measures.

In the West, where AID is on the rise, it is still cloaked in secrecy and deception. Annas, evaluating the status of AID procedure for 6,000 to 10,000 individuals per year notes 'a general lack of standards and the growing use of AID for husbands with genetic defects and for single women, the findings tend to indicate that current practices are based primarily on protecting the best interests of the sperm donors (whom the author calls 'sperm vendors') rather than those of the recipient or resulting child'.[45] A similar account of the complex web of relationships involved in AID is given by Snowden and Mitchell.[46]

In vitro fertilisation (IVF)

In a way IVF may be considered analogous to artificial insemination by husband (AIH): due to an obstruction in the oviduct in the female, ovulation and consequent uterine implantation following normal fertilisation cannot take place, and surgical removal of oviductal obstruction entails infertility or some other complication. In a model case, the wife's ovum and the husband's sperm are fertilised outside the woman's body and the fertilised ovum is transferred to her uterus. The first successful human *in vitro* fertilisation resulted in the birth of the first 'test tube baby', Louise Brown, on 25 July 1978. Having established an analogy between AIH and IVF, further discussion is uncalled for, in so far as IVF is limited to the model case discussed above.

A rather improved form of this pro-conceptive technology, which is still in the experimental phase, is *in vivo fertilisation*. The procedure is directed to facilitate the passage of the ovum through obstructed Fallopian tubes and involves the suction of the ovum and its re-implantation below the point of obstruction. No extra-uterine fertilisation is carried out. *In vivo* fertilisation has not yet been given a human trial. However, if the sequence of the procedure stays as it is, it would be safely considered a corrective procedure.

Sterility and infertility

In the complexities of human reproduction, organic disorders originating in either member may halt the process of reproduction. Traditionally, in the West, such an occurrence was attributed to the female's inability to procreate, while the male was regarded as eternally virile. Islam, duly recognising the biopsychological make-up of male and female, did not condemn the latter exclusively for 'barrenness', as is borne out by the

wife's prerogative to ask for divorce from an impotent mate. The husband's prerogative of divorce from a barren woman must not be equated with that of the woman, for divorce, though permitted, is most disfavoured and reconciliation is strongly urged.

Some of the reproductive technologies discussed in the previous sections are gaining application in the treatment of sterility and infertility. In the case of male sterility, artificial insemination by donor (AID) is one such example and the Muslim response to such 'corrective' procedure has already been discussed. Male sterility characterised as varicocele (where sperm production is disturbed by the scrotal varicose veins) has been successfully treated by surgical procedure, as for instance the surgical removal of an obstruction in the vas deferens. (It may be pointed out that the latter disorder usually ensues as a result of sexually-transmitted diseases!)

The corrective procedures in case of female infertility take a different turn. We have already seen that IVF, or for that matter, *in vitro* fertilisation in model case sequences carry no serious repercussions. Consideration is given to the ovulatory disorders in females wherein ovulation fails to occur. This may be corrected usually by the administration of synthetic hormones which act to regulate the release of gonadotropin-releasing hormone for the final correction of the ovarian hormonal cycle. It can be readily seen that this procedure too falls within the safe boundaries.

However, following ovulatory disorders in females if an attempt is made to implant an ovum which is either fertilised by the husband's sperm or a donor's sperm, serious questions arise concerning the lineage as already discussed in connection with AID, because obviously the ovum does not belong to the host uterus even if it was fertilised by husband's sperm. In case of fertilisation by donor's sperm, a double dose of illegitimacy is self-evident. Or if, as an extension of the model case IVF, the fertilised ovum is instead transferred to the uterus of another woman for reasons of gynaecological complication in the genetic mother, the same clause of illegitimacy would apply – but raising serious questions about the concept of parenthood.[47]

Biological and social parenthood

Islam does not permit any adoptive or foster relationship wherein the biological identity of the *adopted* one is concealed or distorted:

> Never has God endowed any man with two hearts in one body: and [just as] he has never made your wives whom you may have declared to be 'as unlawful to you as your mothers' bodies' [truly] your mothers, so, too, has He never made your adopted sons [truly] your sons: these are but [figures of] speech uttered by your mouths – whereas God

> speaks the absolute truth: and it is He alone who can show [you] the right path. [As for your adopted children,] call them by their [real] fathers' names: this is more equitable in the sight of God; and if you know not who their fathers were, [call them] your brethren in faith and your friends.
>
> (*Al-Aḥzāb* (33):4–5.)

The emphasis on the preservation of one's biological and lineal identity (the implications of which are already evident in the context of *zinā* and *nasab*) extends into the social domain as well, corresponding to the biological differentiation of social roles. This appears epitomised in the case of a Muslim married woman:[48]

> For while she takes on a new marital identity and may be called wife of so and so, she still retains her old lineal one. There is no diffusion of identity here; the one is not subjected to or absorbed by, the other. Each entails certain rights and obligations, and both persist independently of each other.

Islam's insistence on the biological and social integrity of individuals is limited in so far as the true biological identity is concerned. It does not imply any inherent 'superiority', as the Qur'ān makes it abundantly clear that it is individual piety that matters and not biological individuality:

> O men! Behold, We have created you all out of a male and a female, and have made you into nations and tribes, so that you might come to know one another. Verily the noblest of you in the sight of God is the one who is most deeply conscious of Him. Behold, God is all-knowing, all-aware.
>
> (*Al-Ḥujurāt* (49):13.)

It has been made clear that artificial insemination by donor (AID), and *in vitro* fertilisation (IVF) raise serious questions about the concept of parenthood. We have also shown that both AID and IVF (excluding the model case) distort and/or conceal the true biological identity of the parents and children. Consider the case of the so-called 'surrogate mother' who literally lends out her uterus to 'help' an infertile couple. A fertile woman, in exchange for money or some sort of psychological 'gratification' may agree to become pregnant by AID or may consent to act as the 'uterine host' for the husband–wife IVF. In this case, the surrogate mother does not make any genetic contribution to the offspring she carries: she merely serves as a reproductive vessel.

The concept of surrogate mother alters the traditionally accepted and biologically sound parental behaviour not only in its biological dimensions but in its social extensions as well. Islam recognises a single, inte-

grated parental behaviour emanating from *both* parents in which *biology* is an integral constituent of social behaviour. It puts equal genetic emphasis on both parents, as shown in its concept of lineage, and holds both of them responsible for the social obligations of such a genetic marriage. Islam, therefore, does not endorse parenthood as two distinct entities: biological and social – Muslim parenthood is biosocial.

The differentiation of parenthood into separate biological and social compartments with little or no concern as to how the former merges into the latter, and the manipulation of modern reproductive technologies to accentuate such a differentiation create a socially disruptive scenario: donation of embryos for transplantation elsewhere with the pseudo-consolation that the aborted foetus is not being 'killed'; free exchange of frozen human sperm for 'home insemination'; and surgical exchange of ovaries and uterus.[49]

Eugenics

Eugenics is a racist term, implying the 'superiority' of one human race over the other – usually white over black. Here, our discussion is restricted to those human interventions in the process of human reproduction which are obviously motivated by this racist concept, at least as it has been promoted in the West.

Criminality, mental retardation, prostitution, delinquency and similar behavioural traits were understood to be characteristics of 'inferior' races and the only way to eliminate their further spread was to stop their genetic transmission. Thus in 1907 the State of Indiana enacted the forced sterilisation law and the immigration laws prevented the entry of members of the 'inferior' stock. Forced sterilisation was carried out upon thousands of Americans.[50]

The Eugenics Movement of the early 1930s in the United States, Britain, France and elsewhere in the West was spurred by discoveries in the field of genetics. It has gained a new momentum evidently by the inception of Repository for Germinal Choice in Escandido, California. Headed by an elderly optometrist, Robert Graham, the Repository solicits sperm from Nobel prize-winners, keeps them frozen and offers them for artificial insemination to women of 'superior' intelligence who have sterile husbands.

The racist potential of the neo-Eugenicists appears to have been tremendously increased by the discovery of a relatively simple technique: recombinant DNA (rDNA). In essence, it involves a selective insertion or deletion of certain genes and manipulation of the biomolecular structure of genetic material. rDNA technology can now isolate and identify the eukaryotic genetic structure, insert natural or synthetic genes into the host cells, and study genetic functions under strictly controlled conditions.[51] As a result,

previously unknown living systems can be produced. Some of the gene products that have already been produced in commercial quantities include an anti-viral protein Interferon, insulin, growth hormone and cloned antibodies.[52]

Recombinant DNA technology has awesome power and frightening social implications.[53] Some of its ethical implications, from an Islamic point of view, include its exploitation for sexual selection, genetic screening for gender specificity, and tinkering with genes for an artificial insemination prejudiced by certain social concepts, such as racism. Obviously, rDNA technology can also bring tremendous benefits for mankind. It can lead to improvements in human health, say, for example, by giving us Interferon which promises to be an exceptionally valuable drug, deeper understanding of cancer, development of safer and better food plant varieties, and an overall improvement in our understanding of genetic functions. So, it is a science that holds out both a vast potential for benefit and the seeds of human destruction itself.

It seems to me that in the area of reproductive biology good and evil always exist side by side. The question that Muslim jurists and scholars need to ask is whether the good outweighs the evil. The value judgements required to keep on the side of the good are very subtle. It requires not only detailed knowledge of such fields as recombinant DNA, but also a very deep understanding of human nature.

Perhaps there is something in human nature, including the nature of the most devout Muslims, which led the Prophet Mohammad to ban astrology. He acknowledged that it was a valid field of knowledge that brought benefits to those who practised it. Nevertheless, he banned it saying that its potential to mislead was much greater. Similarly, the Qur'ān acknowledges that there is some good in alcohol, but its potential to cause social problems is much greater. The Qur'ān therefore forbids alcohol saying that the sin in it is much greater than its usefulness.

Muslim scholars and scientists need to give some serious thought to contemporary developments in reproductive biology and assess, from an Islamic point of view, whether the good in them outweighs their potential to lead Muslim societies away from Islam.

References

1 Graham Heath, *The Illusory Freedom - The Intellectual Origins and Social Consequences of the Sexual 'Revolution'*, William Heinemann Medical Books Limited, London, 1978, p. 31.

2 Tem Horwitz, 'Wishbones, Condoms, Pessaries and the Pill', in Sally Banes, Sheldon Frank, and Tem Horowitz (eds), *Our National Passion - 200 Years of Sex in America*, Follett Publishing Company, Chicago, 1976, p. 121.

3 Vern L. Bullough and B. Bullough, *Sin, Sickness and Sanity - A History of Sexual Attitudes*, Garland Publishing, New York, 1977, p. 10ff.

4 Richard Lewinsohn, *A History of Sexual Customs*, translated by Alexander Mayce, Bell Publishing Company, New York, 1958, p. 7.
5 *Ibid.*, p. 8.
6 Steven Goldberg, *The Inevitability of Patriarchy – Why the Biological Difference between Men and Women always produces Male Domination*, William Morrow and Company, New York, 1973.
7 Elizabeth G. Davis, *The First Sex*, Penguin Books, Baltimore, 1971.
8 Simone de Beauvoir, *The Second Sex*, translated and edited by H.M. Parshley, Bantam Books, New York, 1953.
9 E. Westermarck, *History of Human Marriage*, Macmillan Company, New York, 1922.
10 R.N. Whitehurst and G.V. Booth, *The Sexes – Changing Relationships in a Pluralistic Society*, Gage Publishing Limited, Toronto, 1980, pp. 5–6.
11 *The Jewish Encyclopaedia*, Funk and Wagnells Company, New York, 1905, see under *Niddah*, p. 301.
12 J. Delaney, M.J. Lupton, and E. Toth, *The Curse – a Cultural History of Menstruation*, E.P. Dutton and Company, New York, 1976, p. 16.
13 Robert N. Whitehurst, R.G. Frisch, and S. Serok, 'A Comparison of Canadian and Israeli Separation and Divorce', *International Journal of Family Therapy*, vol. 1, no. 4, winter 1979.
14 Robert Wood, 'Sex Life in Ancient Civilizations', in A. Ellis and A. Abarbanel (eds.), *Encyclopaedia of Sexual Behaviour*, Hawthorn Books, New York, 1961, vol. 1, p. 125.
15 Davis, *op. cit.*, p. 35.
16 Vern L. Bullough, 'Sex Education in Medieval Christianity', *Journal of Sex Research*, vol. 13, no. 3, 1977, pp. 185–196.
17 Harold Speert, *Iconographia Gyniatrica*, F.A. Davis, Philadelphia, 1973, p. 452.
18 Andrea Dworkin, *Woman Hating*, E.P. Dutton, New York, 1974, pp. 129–130.
19 Sheldon Frank, 'Sex and the Puritans', in Banes, Frank, and Horwitz (eds.), *op. cit.*, p. 8.
20 Josette Feral, 'The Dialectics of Feminist Movements in France', *University of Michigan Papers in Women's Studies*, vol. 1, no. 4, 1975, pp. 113–22.
21 Translation of Qur'ānic *Ayat* is provided after *The Message of the Qur'ān*, English translation by Muhammad Asad, Dar al-Andalus, Gibraltar, 1980.
22 *Ibid.*, p. 101.
23 See, for instance: Kathleen Barry, *Female Sexual Slavery*, Avon Books, New York, 1981, pp. 184–94.
24 Raymond Crawfurd, 'Superstitions of Menstruation', *The Lancet*, 1915, December 18, p. 1331.
25 Paula Weideger, *Menstruation and Menopause – The Physiology and Psychology, the Myth and the Reality*, Alfred A. Knopf, New York, 1976, p. 90.
26 Mohamed Abdel Lateef, 'Menstrual Hygiene – An Experimental Study concerning Qur'ānic Fact and the Jewish Fallacies', in *Second International Islamic Medical Conference Abstracts* (March 29–April 2, 1982), Ministry of Public Health, Kuwait, 1982, p. 77.

27 Muhammad Asad, *op. cit.*, p. 49.
28 Saeed M. Awadhi, 'Medical Aspects of '*Azl* in Islamic *Fiqh*', in Ibrahim El-Sayyad (ed.), *Papers Presented to the First International Conference on Islamic Medicine Celebrating the Advent of the Fifteenth Century Hijri*, Ministry of Public Health, Kuwait, 1981, pp. 295–8.
29 George Devereux, *A Study of Abortion in Primitive Societies – A Typological, Distributional, and Dynamic Analysis of the Prevention of Birth in 400 Pre-Industrial Societies*, revised edition, International Universities Press, New York, 1976. See also, Norman E. Himes, *Medical History of Contraception*, Gamut Press, New York, 1963, ch. VI, 'The Islamic World and Europe during the Middle Ages', pp. 135–69.
30 Sikandar Hussain, 'The Clot (*Al-Alaq*)', *Islamic Quarterly*, vol. 24, no. 3–4, 1980, p. 110.
31 *Ibid.*, p. 109.
32 *Ibid.*, pp. 109–10.
33 Majid Ali Khan, *Islam on Origin and Evolution of Life*, Idarah-i Adabiyat-Delli, Delhi, 1978, pp. 89–104.
34 Muhammad Abdul Rauf, 'History of Medical Ethics – Contemporary Muslim Perspective', in W.T. Reich (ed.), *Encyclopaedia of Bioethics*, vol. II, The Free Press, New York, 1978, p. 894.
35 Mahmud Zayid, 'Family Planning in Islam', *People*, vol. 6, no. 4, 1979, p. 9.
36 *Ibid.*, p. 9.
37 J.D. Biggers, 'In Vitro Fertilization and Embryo Transfer in Human Being', *New Zealand Journal of Medicine*, vol. 304, 1981, pp. 336–42.
38 International Organization of Islamic Medicine, *Kuwait Document – Islamic Code of Medical Ethics*, Ministry of Public Health, Kuwait, 1981, p. 66.
39 Edward W. Lawless, *Technology and Social Shock*, Rutgers University Press, New Brunswick, N.J., 1977.
40 G.J. Annas, 'Artificial Insemination: Beyond the Interest of the Donor', *The Hastings Institute of Society, Ethics and Science Report*, vol. 9, no. 4, 1979, p. 14.
41 Ann E. Mayer, 'Libyan Legislation in Defense of Arabo-Islamic Sexual Mores', *American Journal of Comparative Law*, vol. 28, no. 2, 1980, pp. 288–9.
42 *Ibid.*, pp. 290–91.
43 Hammudah Abd al-Ati, *The Family Structure in Islam*, American Trust Publications, Indianapolis, 1977, pp. 38–9.
44 Noel J. Coulson, 'Regulation of Sexual Behaviour under Traditional Islamic Law', in Afaf Lutfi al-Sayyid-Marsot (ed.), *Society and the Sexes in Medieval Islam*, Undena Publications, Malibu, California, 1979, p. 68.
45 Annas, *op. cit.*, p. 14.
46 R. Snowden and G.D. Mitchell, *The Artificial Family: A Consideration of Artificial Insemination by Donor*, Allen and Unwin, London, 1981.
47 The Committee on the Life and Sciences and Social Policy, Assembly of Behavioral and Social Sciences, National Research Council, National Academy of Sciences, *Assessing Biomedical Technologies – An Inquiry into the Nature of the Process*, Washington DC, National Science Foundation, 1977; see ch. II, 'In Vitro Fertilization and Related Technologies', pp. 13–31.
48 Hammudah Abd al-Ati, *op. cit.*, p. 27.
49 Stig Kullander, 'Medical Aspects on Transplantations in Gynecology', in Axel

Ingelman-Sundberg and Nils-Olov Lunell (eds.), *Current Problems in Fertility*, Plenum Press, New York, 1971, pp. 62–5.

50 Ted Howard and Jeremy Rifkin, *Who Should Play God – Artificial Creation of Life and What it Means for the Future of Human Race*, Dell Publishing Company, New York, 1977, pp. 47–82.
See also, *Hearings before the House Committee on Immigration and Naturalization, 67th Congress, third session*, 1922, p. 755.

51 J. Abelson, 'A Revolution in Biology', *Science*, vol. 209, 1980, pp. 1319–21.

52 Bernard C. Cole, 'Making Genes with Machines', *High Technology*, Premier Issue, 1981, pp. 60–8.

53 Committee on Science and Astronautics, *Genetic Engineering – Evolution of a Technological Issue*, Report to the Subcommittee on Science, Research and Development, U.S. Government Printing Office, Washington DC, 1972.

PART THREE
Values and environment

7 The emergence of environment awareness in the West

LLOYD TIMBERLAKE

It is convenient to date the beginnings of widespread popular concern with the state of the environment in the West from the publication of Rachel Carson's book *Silent Spring* in 1962.[1] The book warned of worldwide pollution caused by DDT and other chemicals, though it had much more to do with the fate of birds and wildlife than with the condition of human beings. Such a dating is neat because it allows for a tidy ten-year period before the 1972 UN Conference on the Human Environment in Stockholm, a meeting which officially put the environment on the map of the international establishment's list of concerns.

But to praise or blame Carson for starting it all is too simple, for a number of reasons. First, some of the West's most powerful conservation organisations were founded before the turn of the century: notable being the National Trust (Britain) in 1895 and the Sierra Club (US) in 1892. Such organisations were concerned more with keeping people out of 'nature' – protecting wild lands and wildlife – than with the environment in which people lived. The conservationists behind these prestigious organisations had no argument with the basic values of Western society; quite the contrary, they were captains of industry and politics who wanted wilderness preserved for their own enjoyment. The epitome of this type of early environmentalism was perhaps US president Theodore Roosevelt, a champion of free enterprise, a champion of conservation and one of the most ardent hunters who ever lived. This was an age of confidence in Western technology, which was rapidly solving human problems by providing better sources of energy, transport, food and entertainment. The only problem for the conservationists was to keep the factories off the trout streams and out of the deer forests.

Second, most writers tracing the history of the environmental movement are forced to the conclusion that if widespread environmental concerns had not emerged as a rallying point for the large numbers of people who wanted to let off steam at the time, then some other cause would probably have done just about as well:

> The new environmentalism of the 1960's drew much of its support from the young, and especially in the USA. It emerged in the wake of the civil rights and anti-war movements, which swept the campuses of American universities. It provided an expression for the emerging radicalism of the period, the so-called counter-culture. This was profoundly anti-

industrial, with its decisive rejection of the work ethic, its condemnation of consumerism and material values, and its questioning of the rationality of a society which harnessed science to what were seen as the inhuman atrocities of the Vietnam war . . .'[2]

The environment was another convenient stick with which the young could beat the establishment. The radicals saw such concerns as a reason for advocating the overthrow of industrial technocracy. But conservatives also joined the fun, making 'environmentalism' the basis of their own calls for limits on some of the effects of progress.

As the decade progressed, many Westerners' concept of 'the Environment' widened from conservation of wildlife and pristine wilderness to embrace such issues as depletion of non-renewable resources, economic growth, unequal distribution of resources, urbanisation, depletion of species, uniformity of industrial life, the non-sustainability of the industrial society, waste, the domination of science over other approaches to knowledge, the erosion of local cultures and the general inability of the planet to support present rates of industrial and population growth. The environment had not gone bad overnight, but many Westerners' feelings about science and technology apparently had. US scientist Barry Commoner argued that there were few real shortages, but that things were going wrong because of the very nature of the industrial complex. The effort to maximise profits not only created artificial shortages, but wrecked the human environment.

Then in 1972, the Club of Rome published a 'model' of the future which said that real shortages *were* emerging. Examining five variables – technology, population, nutrition, natural resources and environment – the Club's report, 'The Limits to Growth', predicted that a continuation of current trends would cause the global system to 'overshoot' and collapse by the end of the century.[3] Though it has since been heavily criticised as unduly pessimistic, the report introduced the concept of 'outer limits' into discussions of the Earth's systems. It had a profound effect on environmental thinking then, and has heavily influenced the computer models of the planet's future which followed. (The 1980 report for the US president, 'Global 2000', was a forecasting exercise rather than a model. But it came up with a similarly pessimistic picture of the nature of society by the year 2000, if there were no significant changes in population growth, the consumption of natural resources and environmental protection.[4])

But the demonstrations and ideological turmoil which were vaguely referred to in the West as 'the environmental movement' had no effect on the developing nations whatsoever – until, that is, the 1972 UN environment conference in Stockholm forced them to take a stand. That stand was, not surprisingly, negative. How could a Third World nation with

not enough industry to pollute a stream get upset about pollution in the US Great Lakes? Why should Brazilians, proud of their rapid economic growth and eager to use their natural resources to hasten it, allow Britons, who had cut down most of the forests on their island centuries ago, to lecture them on the evils of deforestation? These countries saw pollution as a privilege of the rich and concerns over pollution as a brake on their own development.

The level of the Third World's feelings were best demonstrated at an eight-day meeting in June 1971 in Founex, Switzerland, called to discuss the relevance of environmental concerns for developing countries. The organisers of the Stockholm conference wanted to reassure the Third World nations that they would not suffer financially through the 'North's' twinges of eco-conscience. For instance, they would be somehow taken care of if Northern goods became more expensive due to expensive pollution controls. Developing countries were assured that the Stockholm meeting would point the way to development without side effects. The Founex report gave no indication of how this could be done; neither, in fact, did Stockholm.

Stockholm itself was a very successful consciousness-raising exercise. Its 26 Principles and 109 Recommendations for Action have had a lasting influence on environmental discussions, but it would be difficult to show where any of the Stockholm deliberations had a specific impact on the global environmental condition. Most of the recommendations were impossibly broad; others, on such touchy issues as deforestation and the use of insecticides, were watered down so that developing nations would accept them. There were only a few which set specific targets – a 10-year moratorium on commercial whaling, prevention of deliberate oil discharges at sea by 1975 and a report by 1975 on energy uses – and none of these goals were met.[5]

Yet individual countries – even regions of the globe – have made great strides in cleaning up their environments. In North America and Western Europe air quality has improved, noise pollution is better controlled and there are strict laws governing the nature and quantity of materials which can be released into the atmosphere, into bodies of water and into the ground.

How has this been achieved? Stephen Cotgrove suggests that the goals of the environmentalist is at odds with the goals of the wider society. Many studies show that US citizens put high value on such ideals as personal freedom, individual rights, democracy, equal opportunity, achievement, success, material comfort and progress. 'Environmental quality is notably absent,' Cotgrove finds. This has meant that the environmental movement has had to change from a movement which sought a consensus within a society to a movement which worked through

conflict. In other words, it gave up trying to persuade every citizen of the rationality and basic goodness of recycling bottles, and has worked instead to establish government agencies and laws to control these and other environmental activities. As the movement continues to work against the dominant values of society – personal freedom, success, progress, growth, etc. – it naturally becomes more radical.

If this syndrome is true – and Cotgrove is quick to note that it is only one strand in the complex weave that is environmentalism – then it goes a long way to explain why the most environmental progress has been achieved in the Western democracies. These have a large pool of well-educated potential environmentalists and the mechanics whereby they can get their concerns turned into laws and regulations.

The argument that environmentalism is opposed to the traditional values of Western society is perhaps best supported by the actions of the Reagan administration, which has worked since taking office to weaken regulations on air and water pollution, to remove power from such organisations as the Environmental Protection Agency and, under the leadership of Secretary of the Interior James Watt, to open recreational wilderness lands to the drilling and chopping of oil and lumber companies. Thus in the US conservation is not a priority for conservatives. The Reagan administration's actions have had the result of environmentally 'radicalising' thousands of previously unconcerned Americans – if that is what the rapidly growing membership in the Sierra Club and other environmentalist groups indicates is happening. These groups – once filled with the nation's establishment – have also become more radicalised, to the extent that in 1982 several joined together to publish an indictment of Reagan for his crimes against the environment.

If environmental clean-up came simply as a result of government leaders seeing the errors of their ways and taking steps to make surroundings healthier and more pleasant for their people, then one would expect the nations of Eastern Europe to be far ahead of the West in this field. In those centralised economies, industry, commerce and agriculture are run by decree from the capitals. The environment should be easier to control under such a system. For example results of a study by scientists and doctors indicating that, say, lead pollution was adversely affecting the health of workers should be able to move more quickly from scientists and doctors to the government, and for government regulations on such pollution to move quickly to the factories. There should be none of the messy arguments and delays that one gets under 'free enterprise'.

And in fact, in the Soviet Union, pollution standards are much stricter than in the West. But there is growing evidence that these standards are ignored, and that the Eastern European communist countries have some of the world's worst pollution. B. Komarov[6] paints a picture of wide-

spread environmental degradation and increasing incidence of cancers, lung disease and genetic defects. Hard environmental information from Eastern Europe is difficult to come by, but, during the reign of the independent trade union Solidarity in Poland in 1980–81, the curtains parted briefly and the West saw how a sophisticated central economy, with good science, controlled its environment. Scientists belonging to the 'Ecology Club' reported that their studies of pollution and its effects had been ignored by ministries for years. The various ministries – Mines, Industry, etc – are judged on output and profit, not on the health of the workers or of people living near the plants and mines. For instance, the region of Katowice, which covers 2 per cent of the country's area and contains 10 per cent of its population, produces 31 per cent of the nation's coke, 32 per cent of its electricity, 52 per cent of its steel and 98 per cent of its coal, and it extracts and processes all of its zinc and lead ores. But its people have 15 per cent more circulation disease than other Poles, 30 per cent more tumours and 47 per cent more respiratory disease. Workers' homes are built right next to factories and smelters, and the lead content in their garden soil ranges from 42 ppm to 890 ppm, the national limit being 20 ppm. The republics for and of 'the workers' lack the means whereby the workers can get their concerns to the government, and the only lobbying the workers of Katowice can do of their government is through their mortality and morbidity statistics – if these in fact are collected by the governments.[7]

If environmentalism is not a high priority for the leaders of developed democratic nations possessing both a well-educated citizenry and methods for turning protest into legislation, then one can imagine how low a priority it must be for the leadership of most developing nations. Environmentalism is a different problem in the Third World. In the North many of the more obvious and well-documented problems are caused by the big industrialist and the big farmer – men with power. The same sort of thing can happen in the South as well, when big companies, usually multinationals, cut large swathes of forest for timber with no thought of how the yield is to be sustained, or cover huge areas of arable land with monoculture plantation crops, using more and more inorganic fertiliser to make up for the declining nutrition of the soil.

But it has recently come to be accepted that most of the deep environmental problems of the Third World are caused by the poor, in most cases the rural poor. In trying to find fuel for cooking they overcut trees or burn dung which should be returning nutrients to the soil. In trying to raise food to eat they must cut and burn forests to get land or must farm steep hillsides. In both cases the result is often serious erosion, floods and the disappearance of topsoil. The dung and wood fires of many Third World cities cause a denser and more harmful air pollution than that of the

biggest Northern industrial cities. Some 60 per cent of the population of Calcutta suffers from respiratory disease – not discomfort but disease – because of the air pollution.[8]

The documenting of this syndrome has led to a change in the way in which environmentalism is thought of in developing countries. About the time of the Stockholm conference, typical messages from well-meaning environmentalists of the North were 'Don't pollute', 'Don't cut down forests' and 'Don't overuse topsoil'. As noted earlier, such warnings were seen by Southern leaders as a brake on their development. Lately the messages have been more positive: 'Develop environmentally sound technologies', 'Share limited resources fairly' and 'Develop sustainable uses for renewable resources'. This is not merely a matter of semantics. The deeper message behind this change of emphasis is that steady and sustainable development is impossible unless the bits and pieces which make up the environment – soil, water, forests, wildlife, etc – are used in a sound and sustainable manner.

This message has reached many Third World scientists working in the field. Forestry experts in Niger *know* that their country is running out of firewood. At the present rate of use there will be no trees left in the country in 23 years, according to a University of Arizona study. Scientists in the Philippines *know* that the tropical moist forest of that nation is disappearing too fast. Recent satellite photos show that forests now cover only 30 per cent of this timber-exporting nation. But the government feels that 46 per cent coverage is the minimum for both economic and environmental needs. A consortium of Philippine research groups has warned that the nation may not be able to produce enough timber even for domestic consumption by the year 2000.

But it is hard to get this message through to the ruling elites in nations in which the mechanics of democracy are still rudimentary. In the North, improvements in the environment – in the quality of the air, the water and the wilderness areas – bring an obvious benefit to the wealthier citizens. Their quality of life is improved. The poor, living in ghettoes or near steel mills or on small impoverished farms, still suffer from a degraded personal environment. But improvements in the kind of environmental problems which make up the main concerns in the South do not improve the lives of the relatively small urban elites of these nations. Halting desertification will not make life more pleasant for a government minister living in Ouagadougou, conserving topsoil will not improve the daily round of a government minister in Delhi. In the Third World it is not only the poor who tend to cause environmental degradation, it is the poor who suffer from this degradation. They often lack the education to recognise the nature of the trouble facing them; they lack the systems of communications to compare their problems with those of others similarly

placed; they also lack the political power to bring any pressure upon the government.

In the North, the environmental movement has become more radical in the sense that it has moved from efforts to seek consensus to confrontation with centres of power. In the South, the rulers themselves seem to have slowly come to realise that their environmental problems require radical solutions, and that poverty is the worst polluter. For instance, effective land reforms might be the most effective way to keep rural peasants from farming marginal land and thus causing erosion, floods and loss of nutritious soil, and from axing forests to clear ground for farming. Allowing food prices to rise in cities and cutting down on imports of food aid might bring money and development to the countrysides of many African countries, improving education and alleviating the grinding poverty which causes environmental degradation.

Few governments, however, are willing or able to take such radical steps. This gulf between what should be done and what is being done led to a strange spectacle in Nairobi in May 1982 when the nations of the world gathered to celebrate the 10th anniversary of the 1972 Stockholm conference and to rededicate themselves to an improved global environment. The speeches of the few heads of state and the many ministers representing Third World governments sounded tough and radical, compared with the noises the same governments made in Stockholm[9]. Sudan's president, Jaafar al Nemery, said that the conflict at Stockholm between environment and development was fading and nations were seeking the goal of 'development without destruction'. Kenyan President Daniel Arap Moi said that, given the poverty of much of mankind, 'vast communities are compelled to live in a manner which destroys valuable soils, water resources and vegetative cover.... There is no doubt that poverty is a principal sponsoring mechanism of continued and desparate destruction of natural resources.' But after these tough statements, the leaders' speeches trailed off into strange non-sequiturs, such as calls for nuclear disarmament. Moi is correct to wonder 'What would happen if the intellectual, technological and material capacities now deployed for stockpiling of armaments were switched to the worldwide provision of basic human needs?' But Kenya's population is growing at a rate of almost 4 per cent a year, one of the highest rates of increase in the world. There is not enough land to go round. The hills not far north of Nairobi are being stripped of trees in efforts to secure fuelwood. A study by the Beijer Institute of Sweden reveals that the nation faces a disastrous energy crisis due to diminishing wood supplies. The north of the country is suffering from desertification. President Moi will not pull much weight in the nuclear disarmament councils of the world, but he presumably does have influence over his fellow Kenyans and their problems. Ironically, Moi

may have put his finger on the root of Kenya's environmental troubles when he said: 'It is the lack of political will to allocate resources, rationally and for the benefit of mankind, which is the real problem'. Perhaps he did not mean to make it sound so much like a personal confession.

Thus environmental improvements are difficult enough in Northern democracies, much more difficult in the centrally planned economies and, for different reasons, equally difficult in most Third World countries. But what is happening in the wealthy Third World? Most such countries have oil, and most oil-rich developing nations are Muslim. The Christian god tells his people to 'replenish the Earth, and subdue it'. But Islamic approach to environment, as Pervaz Manzoor argues in the next chapter, is much more environmentalistic. Thus the Muslim states blessed with the wealth of oil should, in theory, be models of environmental concerns and control.

This is certainly not the case. The wealthy Muslim states have failed right across the environmental spectrum: from holding back the deserts, which many of their nations contain, to building functional and aesthetically pleasing modern buildings. The problem may be very simple in such a region as the Gulf: eight nations are trying to squeeze a century of development into a decade. In some cases the number of automobiles is doubling every year, and the populations of some Gulf cities double every four years. Western patterns of development are simply overpowering the environment.

Another reason is that the leaders of many wealthy Muslim nations have become completely separated from both their religion and their roots in the land. Having the money to buy modernity, they ignore the problem of fitting that modernity into the deep and strong traditions of Islamic cultures.

One of the main victims of the blind import of Western technology and uncritical imitation of Western strategies of development has been Islamic architecture. Islamic architecture was once the best in the world. It was beautiful. It turned the glare of the desert sun into pleasing patterns of light by the use of lattices. Made of earth and tiles, it was cool in summer and warm in winter. It trapped breezes and led them gently throughout the structure, cooling the occupants. It resisted the climate for hundreds of years.

Today the Islamic nations are relying on designs of steel and cement, mostly from the West. These buildings are ugly, expensive, energy - intensive and prone to suffer from the local climates.

In a recent study, Hardy and Satterthwait[10] examine the provision of housing in 17 Third World countries. It had little good to say about urban shelter in the Muslim countries considered. Egypt in 1975 faced an urban housing deficit of 1·5 million. It is seeking to solve the problem

through contracts with foreign companies specialising in highly industrialised prefabricated design. This will not only reduce employment where unemployment is already high, but 'the final product is likely to be even less appropriate for Egypt's climate and culture than the public housing blocks already built'. A 1977 UN report found that two-thirds of Iraq's urban dwellers live more than two to a room and one-fifth live more than four per room. And current policy suggests that the very considerable amount of government investment in housing will benefit only the small minority while housing conditions for the majority do not improve, or even deteriorate. And slum clearance schemes are likely only to increase overcrowding. Other Muslim nations have similar problems.

The Gulf is a shallow sea surrounded by eight relatively rich – some exceedingly rich – Muslim nations. In this region development has progressed with little concern for the environment. Bahrein dumps 75 per cent of its sewage (26 million cubic metres a year) untreated into the Gulf, according to a 1980 Earthscan report[11]. The report adds that most Gulf countries produce at least double the domestic refuse per capita of affluent Western countries. Most of this is dumped on land where it becomes breeding grounds for flies and disease. 'When the rubbish is set alight, its high content of rubber and plastic contributes to air pollution.' Earthscan said that, 'In general, pollution emission controls are absent from Gulf countries, and there are no adequate arrangements for disposal of industrial waste.' Saudi Arabia's coastal city complex of Dhahran, Damman and al-Khobar receives over two million tonnes of sulphur dioxide per year from gas flared at the nearby oilfields – 73 per cent of the area's total sulphur dioxide pollution. The catalogue of pollution goes on. Here it is both the very rich and the poor who suffer from an ignored environment. There are signs of change. The eight Gulf nations signed a convention in 1978 as a first step under the Kuwait Action Plan towards controlling pollution and promoting sustainable development. Little progress has been made since then.

Many of the Muslim countries, as I noted earlier, have serious problems with the creeping deserts. The deserts lie at the opposite end of the environmental spectrum from ill-designed buildings and industrial pollution. 'Desertification', the man-made degradation of the land so that it loses fertility and its ability to provide economic returns under cultivation or grazing, threatens some 30 million square kilometres, over 20 per cent of the Earth's surface, the home of 80 million people. Past Muslim cultures showed great skill at controlling this syndrome with intricate crop-rotation schemes, complex irrigation systems and systems for controlling and rotating the grazing among tribes over vast areas of delicate, arid grasslands.

Today, to the great embarrassment of the Muslim nations, it is the tiny

state of Israel which is coming up with virtually all of the new scientific developments for turning the desert green. Efforts in the wealthier nations, such as Libya, seem to consist mainly of expensive and ham-fisted projects to empty underground aquifers out onto the sands through massive revolving sprinklers. Iraq has depended on irrigated agriculture for 4,000 years. That nation's Greater Mussayeb Irrigation project started in 1953. It was badly designed, badly executed by poorly trained staff and badly maintained. In 1965 a $10 million rehabilitation programme was begun, with UNDP and FAO support after 1970. By 1976, according to a report to the UN Conference on Desertification, 64,000 irrigated hectares supported only 32,000 people; farm income represented less than 5 per cent return on capital invested and most farms grew subsistence rather than cash crops. Pakistan has one of the largest irrigation systems in the world: 42 principal canal systems covering 62,000 sq km. But poorly designed irrigation causes waterlogging and salinity, rendering land useless. By 1976, water tables in Pakistan which had been 24–27 metres below ground were at or near the surface. In the country as a whole, almost 50 per cent of the soils are more or less saline, and 20 per cent were highly saline. In Sind, 98 per cent of the soils were saline, of which 50 per cent were highly saline.

The poor Muslim nations of the Sahel suffered a disastrous drought in 1968–73 which killed millions of animals and thousands of people. The drought was caused by the weather, but its effects on the land and people were due largely to environmental excesses of overcultivation, over-grazing and deforestation. Over the years which followed, billions of dollars of aid (much of it from the Arab countries) were pumped into the region. Between 1975 and 1980, $7·45 billion in 'official development assistance' was committed by donors to Sahelian countries. Yet by 1980 only 1·4 per cent of this aid was going to ecology/reforestation projects and only 5 per cent to livestock projects. Herds were back near pre-drought levels. Irrigation projects were breaking down at about the same rate that new irrigation projects were being opened. The area is ripe for another catastrophe.

Why is the environmental track record of the Muslim countries so poor? That question needs urgent attention from Muslim scholars. It is certainly not due to lack of money or appropriate technology. The West became secularised several centuries ago. Whether the Muslim countries are undergoing that process now is an argument for others. But there is a clear rift between the theory of Islamic environment and planning, as presented by Parvez Manzoor and Gulzar Haider, and the practices that exist in the Muslim world. Perhaps one reason for this is that leaders and policy makers in the Muslim countries are alienated from their religious and cultural roots and even from their own people. It is worth noting that almost all Muslim nations have authoritarian regimes. None

have regimes which could truly be described as 'Islamic'. A leadership divorced from its people will be divorced from the environment of the people. The environment will suffer from neglect; and from the gross misuse of money and manpower.

References

1 Rachel Carson, *Silent Spring*, Penguin, Harmondsworth, 1962.
2 Stephen Cotgrove, *Catastrophe or Cornucopia?*, Wiley, New York, 1982, p. 12.
3 D. Meadows *et al.*, *The Limits to Growth*, Potomac Associates, New York, 1972.
4 There are five published versions of *Global 2000*: the complete three volumes published by the US Government Printing Office, Washington D.C.; an abridged version with an introduction by Gerald Barney, Pergamon, New York and Oxford; and a paperback edition *Global 2000 Report*, Penguin, 1982.
5 For a review of development since Stockholm see: M.W. Holdgate *et al.* (eds.), *The World Environment 1972–82*, Tycooly, Dublin, 1982; and Robin Clarke and Lloyd Timberlake, *Stockholm Plus Ten*, Earthscan, London, 1982.
6 B. Komarov, *The Destruction of Nature in the Soviet Union*, Pluto Press, London, 1978.
7 Lloyd Timberlake, 'Poland – the most polluted country in the World', *New Scientist*, 92, 248–250, (22 October 1981).
8 For a wide-ranging survey of energy usage and environmental problems see: J. Milton, *Careless Technology: Ecology and International Development*, Tom Staoey, London, 1972; and V. Smil and W.E. Knowland (eds.), *Energy in the Developing World*, Oxford University Press, Oxford, 1980.
9 Most of the important speeches given at Nairobi Conference have been collected in the Special Issue of *Mazingira* 6 (1982).
10 J. Hardoy and D. Satterthwaite, *Shelter: Need and Response*, Wiley, New York, 1981.
11 'The Gulf: Pollution and Development', Earthscan Briefing Document No 24, London, 1980.

8 Values and the built environment: a case study of British planning and urban development

ALISON RAVETZ

The rise of the environmental movement has had considerable impact on the way we now perceive our built environment. Over the last decade the theory and practice of planning has undergone many reversals and radical new ideas are making planning more responsive to public participation and social needs. One of the most important tasks in planning today is to reconcile the bad legacy of the West in the world it formerly dominated with these new ideas which have emerged largely from its own experiences and mistakes. Western civilisation and technology (in which planning plays an important part) could be viewed as a brave, if somewhat tragic, experiment with the forces of nature. The lessons learned have caused changes in our ideas and policies – however, these are not yet disseminated throughout the world, and particularly in the Muslim countries where discredited Western ideas and policies are still dominant. Architects, building technologists and policy-makers in Muslim countries have a great deal to gain by closely examining the planning experiences of the industrialised nations and looking at the emerging environmentally conscious theories, and practices of planning. The British experience of planning, for example, contains many lessons for those concerned with habitat and values in Muslim societies.

The industrialisation of building

One of the most dramatic failures of recent town planning in Britain – as also in America and many other 'Western' societies – is that of high-rise or multi-storey housing. We now find ourselves having to demolish large and expensive estates of such housing, built only some ten or so years ago with public subsidies, and frequently with public acclaim. Their brief lifespan coincides with a very significant shift in the attitudes and operation of planning, in which traditional values and practices have been seen to be no longer sufficient or feasible. We may use the case of high-rise housing to illuminate some of the main reasons for this shift. This is useful in the present context, for the reasons have particular relevance for those who would seek a planning approach that is truly appropriate for Islam, rather than a Western approach that is not only inappropriate for it, but is in itself undergoing severe crises and changes.

The causes of high-rise housing and its eventual failure to perform as

expected may be defined as economic, social, and technical. The economic mechanism is that of land prices, which rise as demand for land increases, towards the city centre. This apparently universal mechanism gives urban industrial societies their characteristic profiles of land values, where commercial and industrial sites command higher prices than residential ones. This means that central sites are 'too valuable' for poor people, or ordinary working people, to live on them. However, for historical reasons many such people were already located in such areas, for in the early stages of the industrial revolution, before mechanised transport, they had had to live literally in the shadow of their factories. Throughout much of the last century, particularly as commercial and business districts of cities needed more space, it became more and more of a critical question whether these people should be allowed to stay there.

Only two solutions were possible: one was to decentralise working-class housing to the suburbs – a solution that did not begin to be feasible until the advent of public transport systems and working men's fares, around 1900. The other was to rehouse working people on central sites, but in space-saving ways: that is, in multi-storey dwellings. Besides releasing space for commerce, government and industry, this had the advantage of satisfying rising public health standards, for roads, drains and other parts of the urban infrastructure could be provided at the same time.

Accordingly, the British working classes living in large urban centres were being rehoused in flats from about 1850 onwards. They were of bad repute, for the indigenous housing form (outside of Scottish cities) was small cottages in rows or terraces. But the image of multi-storey flats, and hence of public acceptance for them, was renewed in the 1920s and 1930s, under the pressure of the Modern Movement in architecture. This movement's propaganda for high flats had roots in architectural futurism around 1900, but it was most particularly brought to public notice by le Corbusier in the 1920s. It was based on a visionary city that was totally manmade, on multiple levels that integrated every transportation system then known with the buildings. Its scale was enormous, and unlimited. Speed was a dominant consideration – with no realistic consideration of the problems of rush hours and traffic jams. The aeroplane and helicopter were vaguely supposed to provide for a lot of transportation needs. Even aerial warfare, which became an increasingly real concern towards 1940, was not thought in any way to hinder, but rather to enhance the envisaged city. Its building forms owed a lot to the existing skyscrapers of New York and other American cities, but the new city was to be an improvement on these unplanned and chaotic environments. Besides linking buildings to transport, it would provide abundant open space – space that was to be saved by building higher than had ever been built before. This

would reunite man with nature, with sky, sunlight, fresh air and growing things.

Clearly the vision was heavily dependent on the creation of new technologies in construction. The three basic materials were steel, glass and concrete. The first two had undergone their most significant innovations earlier in the century, but reinforced concrete began to be belatedly introduced into Britain, which lagged somewhat behind the rest of Europe, in the 1920s–30s. The First World War (as later the Second) greatly speeded up change in building techniques, because of shortages in materials and labour. More and larger site machinery was introduced, and efforts were made to circumvent shortages, particularly of steel and timber. This encouraged the use of the light steel-framed or, later, the reinforced concrete-framed building. In such buildings floors were cantilevered from the frame and walls were mere membranes that were not load-bearing. This liberated the building to go much higher than the seven or so storeys that had been permitted by load-bearing walls, although the tower block still awaited the advent of lifts and electrical pumping systems after the Second World War, before it could be built much above fourteen storeys. Meanwhile, many new materials and products that immediately became essential to building had appeared: asbestos cement, plaster board, plastics. Each product was backed by a manufacturer or consortium, and such consortia became increasingly effective pressure groups on government and the media, to promote new building and the use of their own products.

The transformation of building technology could not, of course, have taken place without the right climate of acceptance and investment. In this, architects played a leading role, for they made propaganda for the image, the tall, white, light, 'modern' building that the new technology could create. They particularly liked the new kinds of interior space that were permitted by the elimination of load-bearing walls and by glass cladding – although, in practice, the absence of partitions was a dubious advantage for domestic buildings. Movies, magazines, and later television, played important roles in getting the new image accepted. The building industry itself, it was argued, was inefficient and obsolete. The new industrialised building would remedy this and would as far as possible eliminate what was seen as the most wasteful and problematical side of the industry: labour, and particularly skilled labour. Doubtless impressed by the way in which industry had turned out armaments during the war, governments and manufacturers set about putting the building industry on the same footing as, say, aircraft production. As far as possible, site work was to be restricted to assemblage of factory-made products by unskilled workers.

This centralisation of production inevitably ruled out local variations

and traditional materials or techniques. The product was an environment that was universally applied. Building became increasingly capital rather than labour-intensive, and industrialisation was argued to result in great economies, because it was faster, because of the gains of mass production, and the elimination of craft labour. At best, this argument was unprovable, because no meaningful comparison of costs in different periods was possible. At worst, it was fallacious, for as labour costs had only ever been a minor part of total building costs, savings that could be made through labour could only ever be limited. Perhaps what the argument really indicates to us is a fundamental change in the structure and finance of the building industry, from locally based companies that provided a service, to multi-nationals producing products and acting as outlets for big investment.

The ultimate development was that of 'systems building', in which the structural design and its construction materials were devised as a patented package that could be imported and used anywhere. Never as successful in Britain as elsewhere in Europe, for a variety of complex reasons, 'systems' depended on very large orders and long runs for experiment and eventual economies of scale that would ensure their profitability. In practice, as was seen from the inquest on a block of flats at Ronan Point which collapsed in 1968, systems could be and were applied with totally inadequate safeguards for security.

The Ronan Point disaster was a watershed in British housing, planning and public awareness. For multi-storey flats it was a turning point. People who had experience of living in such flats now gave vent to their misery and anger about them, and politicians revealed that they had in many cases been pressured into commissioning them because of the way government subsidies were biased in their favour. In terms of their actual cost to the exchequer such flats were very expensive, and their high site and construction costs resulted in rents that were often grotesquely high for working-class people. Thus some of the fantasies about the economics of industrialised building were exposed.

Similar fantasies about its materials and techniques gradually came to light with experience. Architectural and trade propaganda had ignored the tendency of steel to rust, of concrete to spall, weather, stain and (more importantly) lose its strength, and of glass to let on, or out, too much heat. Some of the new, and also some of the old, materials used in building were toxic, and some reacted together in unexpected ways that threatened stability of structures. Building collapses, and buildings that had to be demolished became increasingly common. Sometimes new structures created special fire hazards. In their haste to promote industrialised building, its protagonists overlooked the critical importance of fine tolerances and, in particular, the care needed in the placing of joints. Together with

skilled craftsmen, the industry had gradually lost the control traditionally supplied by clerks of works, so that quality degenerated.

Some of these risks were already known within the building industry, and some were new ones, created by a new technology. The same might be said of the social hazards of high-rise building, for there had by now been a long experience of living off the ground. The single largest problem was that of where the children were to play, and how mothers were to communicate with them once they had left the dwelling. Other problems were contributed by the new technology: for instance, many high-rise flats were designed with electrical heating systems over which tenants had no control, and which were prohibitively expensive to run. People then resorted to makeshift and dangerous heating devices, once their electricity was cut off for non-payment. Further problems were contributed by new ideas in design: for instance, the architectural innovation of 'streets in the air' that was supposed to give all the benefits of street life, without the traffic hazards. In reality, streets in the air were barren, draughty and potentially dangerous places from which people fled as fast as possible.

While it should be emphasised that not all high-rise housing in Britain can be branded as 'failed', the various economic, social and technical stresses that we have reviewed are sufficient to give us some insight into the present crisis in British planning, as well as its likely contribution to developing societies in other parts of the world. They naturally induced a mood of self-doubt among the environmental professions, most notably in architecture, and this contributed greatly to the new climate of thought and changes in policy that will be described later. If, for a moment, we take a longer-term historical perspective of the whole phenomenon, we can say that it is to do with the placing of the poor in urban, industrial society, and with problems of creating an urban culture that is safe, from a public health point of view, and that also enables its members to live full and rewarding lives. The earliest working-class urban communities had arisen haphazardly, and they were in many respects felt to be unhealthy and degrading. The particular surprise and tragedy of the period of high-rise housing, the post-war period, is that even though the state and the planning professions were at the peak of their power, their attempts to recreate satisfying communities fell so far short of success. This was so in spite of the high ideals of many of those involved. But, though the ideals were genuine, they were often shallow, or based on fallacies and fantasies. So something that appeared to be benign could result in costly failures. Here and there 'guilty' agents may be identified, but something as large as high-rise housing is, like planning itself, a collective creation, and its flaws must represent flaws in the values of the parent society.

Strands in British town planning: model communities and redevelopment

Multi-storey building was far from being the most important element in the British town planning system. In origin, the goal that this worked towards was supplied by the Garden City movement inspired by Ebenezer Howard around 1900. Physically, the garden city was a smallish market town where housing was almost exclusively in two-storey cottages scattered at low densities. What had at first made the movement inspirational, however, was its radical anarchistic roots. As Howard originally envisaged, the garden city was to be economically self-supporting and in a direct relationship with the surrounding countryside. As it prospered, it was to use its growing revenues for its own social services: care of the young, the elderly, and so on. So this was in essence a model for a new, ideal society. In the event, only two prototype garden cities were founded, and from the earliest days of the movement many members, including Howard himself, looked to the state to speed up and implement the programme. Eventually this came about through the New Towns movement of the 1940s–1960s. In terms of building form, the New Towns began by imitating the Garden City tradition – that is, with low-density layouts and cottage style houses. Later, many of them came under the influence of the fashion for high-rise. But in terms of social organisation they were very different from the Garden City ideal, for they were entirely state controlled, and in fact more centralised than normal urban environments.

The New Towns are always presented as the peak of British town planning, and they are a great deal more successful than the high-rise estates described above – as indeed, considering the resources and talent put into them, they should be. But it is true to say that without a great deal of investment in community development the New Towns would not be nearly as socially successful as they are; and this should be borne in mind when evaluating the new towns of developing countries. The social framework is more significant than the architecture, although good design and building technology are also important.

The British New Towns directly affected only a tiny proportion of the total population or of the built environment. For the rest, town planning depended on powers that local (or town) governments obtained over the urban infrastructure and utilities, from the mid-nineteenth century onwards. A very important extension of local government power came in 1919, with the advent of council (state subsidised) housing. This represented the application of the Garden City movement (in its state centralised version) to the mass housing of the working classes. Through the council housing system, suburban estates of cottages, and later the high-rise estates of flats, were built on a massive scale, and they were rigidly controlled by the councils' housing managers.

Shortly after the end of the Second World War, and partly as an outcome of the growth of state power during the war, new legislation was passed to allow the state to control (as it was thought) all building development. The basic mechanism was the appropriation by the state of all development rights, so that anyone wanting to build had to seek planning permission. The underlying principle governing councils in the awarding of planning permission was that of zoning: the separation of different activities into different parts of the city. Unlike the United States, zoning never quite had legal force in Britain, but rather, it operated spontaneously as the outcome of the normal working of the land market which, as we have seen, gave preference to offices and shops rather than housing. The planning system reinforced this pattern, for, as part of the Garden City philosophy, it believed that homes needed to be segregated from almost all other urban activities. The postwar city, therefore, came more and more to be parcelled into separate sectors for offices, shops, factories, educational and government buildings, while at the same time the scale of the city became more and more extended. Among the consequences of this were transport problems, notably the problem of 'rush hour', and the separation of women, children and the elderly from the world of paid work. It became the pattern, in large cities, for jobs and homes to be widely separated – indeed, as population grew, in the large conurbations, many people *had* to work and live in different towns.

It was axiomatic that the urban environment would require continuous renewal under the planning system. It was supposed that, other than historical monuments, no environment was, or should be, lasting. Rapid obsolescence (which was very compatible with the industrialisation of building) was regarded as a good, rather than a bad, thing. The main instrument for this renewal was the same that had already placed working people in high flats during the nineteenth century: slum clearance. The difference was now that local councils could declare slum clearance areas without having to pay massive compensation to the landlords. Houses could be condemned as unfit to live in, compulsorily purchased at the existing market price, and demolished, so that the sites were available for other uses. Part of the mechanism was that the market value of a house declared unfit to live in was very low, so that house owners, and also small shopkeepers and small tradesmen, could be dispossessed with very little compensation. The placing of an area in a slum clearance programme, or even the expectation of placing, was sufficient to 'blight' a neighbourhood, socially and economically, sometimes years ahead of actual clearance. The effects of such blighting were to inhibit owners and residents from carrying out repairs or improvements, and to prevent institutions or individuals from investing either money or confidence in the area. In this way, districts that were functioning normally in the 1950s

or 1960s had, some ten years later, become the irremediable slums that councils had originally declared them to be.

At the same time, property speculators working covertly and on a large scale were able to buy up sufficient properties in blighted areas, often using tactics of intimidation. Eventually they assembled sufficient plots to have a development value, and they would, with the council's planning help, carry out large shopping and offices schemes that were highly profitable to themselves. In this way central and inner areas of cities were transferred from multiple, small owners to corporate ownership under large property and financial institutions.

The amount of such development was in the last resort, however, limited. In parts of all large cities, and most notably throughout deprived regions of Britain, the capacity of the planning system to blight and clear ran ahead of any capacity to redevelop. The result was what came to be recognised during the 1960s as the 'inner city problem'. In this, economic, social and governmental problems combine. The more profitable activities, and the more skilled and ambitious members of the population have moved away, leaving behind them a population of unskilled, low-paid, unemployed, elderly and immigrants. Together they constitute a client population with a great need of state services; but the absence of understanding and trust between them and their rulers is very great. The inner city problem is, of course, much larger than merely a problem of town planning. It is the problem of an ageing industrial system, perhaps in its terminal stages. What is significant about the relation of town planning towards it, however, is that it had no strategies for it, and indeed seemed completely taken by surprise by it.

Some fifteen years after its first definition, the inner city problem in Britain began to be compounded by mass youth unemployment, which was most severe in inner city areas, and by stress among immigrant populations. Rioting and looting, familiar in the United States since the 1960s, began to occur in British cities. In Northern Ireland, urban violence was the product of an apparently interminable war. Large council estates that had 'failed', especially high-rise estates in Glasgow, Liverpool and other old industrial cities, already looked like scarred battlefields. It was not unreasonable to imagine that British cities would follow the pattern of America, where abandonment and arson are everyday realities.

The inner city problem is the symptom of a malaise that is far wider and deeper than a mere spatial problem. This is confirmed by the fact that similar, though much less publicised, deprived areas have developed on the fringes of cities, in the large suburban council estates now up to fifty years old. The only difference between these and inner city areas is that they do not lend themselves to property speculation; hence their inhabitants are not under threat of dispossession, but rather, they have been

deliberately placed in their present locations. For the purpose of drawing comparisons and inferences from Third World societies, it is important to remember that the pattern of social, economic and spatial deprivation in British society can be either central or peripheral in the city.

The values of British town planning

Because its protagonists invariably present the British planning system as 'progressive' and 'scientific', it is popularly considered to be entirely value-free. This acts as a sort of screen, through which it is difficult to see the possibility of other choices and values that were, or are, feasible but not taken. In this, as in any other system of policy and practice, certain things were assumed to be permissible, and others not – one may compare the Islamic principles of *ḥalal* and *haram*. It is only when the unquestioned assumptions are taken apart and examined that we can understand the shortcomings of the system.

British town planning was ambitious and optimistic. It assumed that, with few limited exceptions, the whole of the urban environment inherited from the past was obsolete and fit only to be discarded. What was needed was a 'clean-sweep' approach to all environments. Planning was required to act on a national scale, and, when necessary, planners were willing to operate on a global scale – as we shall see in the next section. It followed that, if whole environments were to be rejected, new, large-scale and fully comprehensive and integrated new ones were needed to take their place. The provision of these might seem to be a rather ambitious task; but as we have seen, both the technology and the ideas were to hand. All the different political persuasions agreed that the state should take control over the whole environment, so that it could be planned scientifically and efficiently. Working through the state, the various specialist environmental professions were to prescribe what environments were to be created. Like other scientific or technical expertise (as, for instance, in medicine, engineering, or warfare) these prescriptions were regarded as being, in the last resort, beyond question: certainly beyond question by unqualified lay people. Formally, the ultimate decision as to what was or was not done lay in the keeping of elected politicians. They, however, had to make such decisions within the limits of a large and growing body of planning law and precedent, and of rapidly changing technologies that, in practice, only full-time officials and practitioners could really master and operate. The power of the professionals, therefore, was very considerable – and all the more so because, in formal terms, they were not really supposed to have power at all.

Two immediate outcomes of this 'clean-sweep' style of planning were that the same rules were applied to all places, regardless of local differences (thus, with building technology, accounting for the uniformity of

twentieth-century development) and the imposition of new, 'model' environments. Like high-rise housing, these were often accompanied with many promises based on fantasies, and, however large and successful they might be, there were always margins at the edges, where they did not knit happily with the old environments, but created a sort of no-man's-land of blight and underdevelopment. In fact, it was seldom, if ever, that new environments were speedily and completely finished. They usually took years to complete, during which planning intentions might be changed or abandoned, or the money supply be cut off. At the end of the whole process, the worst of both worlds might prevail: the old environment irrevocably damaged, and the new one raw and never to be finished.

This style of planning inevitably ruled out the gradual and spontaneous evolution of environments. The controlling professions and the state carried out planning in a framework of determinism: that is, planned environments were supplied *in order* to bring about social wellbeing and improvement in the standard of living and quality of life. When such improvement is examined for its actual meaning, we see that it invariably means improvement in material goods (including faster travel over greater distances). Material improvement is seen as a good, either for its own sake, or as a barrier to misery (such as disease, for instance), or the gateway to non-material things – leisure, community, and so on. The appeal, and indeed the solid basis, of such materialism can easily be appreciated. The fallacy of the deterministic approach appears only when we remember that it often ignored, or even increased the deprivation of, minority groups; that it often in fact imposed its benefits on unwilling recipients, whose actual environmental needs and behaviour it ignored; and that it had to operate on the supposition of professional infallibility, despite the fact that repeated examples of the contrary reinforced public disillusion.

The ultimate fallacy was, of course, that material resources were infinitely expanding, for town planning was dependent for its very existence on economic growth. Although in retrospect it seems incomprehensible, planning shared with the rest of its society the belief that developing countries would continue indefinitely to provide the cheap raw materials on which industrialism depended. The watershed came in 1973, with the OPEC oil embargo. Even after that, however, it took people and institutions in the West years to adjust to the idea that the world's resources were not infinite, and that their own share of them, in particular, could not be taken for granted. Such a realisation would make it possible to re-evaluate the values and goals of planning – to consider, for instance, whether it was possible for planning to have other than a materialist basis. But for those who were unable to think radically and constructively in an

unfamiliar world, its falling about their ears seemed a disaster from which there was no positive way out.

The export of planning

Under imperialism, there had been no question of town planning being applied to all parts of the colonised environment. British planning ideas were widely exported (as were German and French planning) to the Muslim World but the British planning *system* could not be fully replicated in any other society because it was too dependent on social, political and legal systems. Planning ideas and policies were applied, therefore, in those parts of colonised societies where the ruling race had most control: military and government areas, the western commercial centres, and the residential and leisure districts of the rulers. The indigenous parts of the environment might, variously, be contained, ignored, or slighted; and of course indigenous society was heavily influenced by Western culture, and in particular by its architecture and the symbolic associations of building techniques and forms.

After independence, Western financial aid perpetuated this cultural dependence, and Western professionals returned to rule in a veiled guise, as consultants. The advice they gave was often absurdly inappropriate for the societies in question. This was not surprising, considering that, as we have seen, they were capable of doing inappropriate things even in their own society, and that they believed planning to be an independent expertise, not dependent on other social systems. So they would tend to use prescriptions and images they had learned in their own training at home: for instance, they would attempt to divide cities into zones, on the model of Western industrial cities, to devise road systems for places where scarcely anyone could ever hope to own a car. They often quite cynically went trawling for commissions, particularly in the oil-rich countries, with quick profits in mind. Some consultants spent mere days in places for which they were designing large-scale, long-term development plans.

With the ideas and images, building technology was also profitably exported, easily usurping idigenous materials and techniques that had had no time to adapt to massive population growth and urban immigration. In poor, hot countries the myths of industrialised building became even more blatant. Steel, glass and concrete lost their justification of cheapness, and the multi-storey glass building required expensive modifications in tropical climates. Quality control could not be guaranteed where there were acute water shortages, or where the necessary social organisation was lacking. Western building forms were extroverted and therefore unsuitable, both for climates where protection from sun was imperative, and for cultures where religion and domestic organisation required seclusion. Lastly, as we have seen, industrialised building was capital-intensive

and had as a goal the elimination of labour. To apply it in countries whose single largest resource was labour was, therefore, socially and economically inappropriate.

In time, many Western planners and consultants came to see that their strategy was wrong, and accordingly they adapted it to be more sympathetic to the resources and real needs of the societies in question. Here, however, they met with the obstacle so graphically described by Hassan Fathy in *Architecture for the Poor*. This was the operation of cultural dependency, in which ex-colonial societies were obsessed with their own inferiority and the superiority of Western technology and expertise. Thus they rushed to disparage their own rich vernacular traditions and adopt (if only as mere symbols) Western-type plans and buildings that would, in their eyes, place them in the modern world.

This was reinforced by the necessity, in the absence of any developed professions of their own, of sending away young people to be educated in the West. Knowing little of their own countries, and perhaps coming from an élitist minority that did not know the common problems or even speak the common language, these adolescents were sent away, sometimes for years at a stretch, during the most formative period of their lives. As aliens in the host country, they tended to learn theories and principles in parrot fashion, and would apply them in a similarly mechanistic way on their return. Neither they, nor indeed their teachers, would be aware of the inherent risks in culture transfers, or aware that, as something having deep social roots, architecture and planning cannot simply be transported. As part of their Western education, they would imbibe the idea that technology is only a material, and not a socially dependent, thing. Therefore, they would naturally suppose that it could be easily exported. They would suppose, also, that as something that is presumed to be politically and morally neutral – that is, value free – it could be exported from one culture to another without in any way offending or placing at risk different systems of value and patterns of living.

Changes and challenges: new trends in British planning and some implications for the Muslim world

During the last ten years the reversals in planning and particularly the urban economic crisis described earlier in this chapter, have brought about some fundamental shifts in planning outlook and styles. But before reviewing these, it must be said that there is a strong school of establishment and popular thought in our society that still believes in a near future of affluence and leisure brought about by technology, in particular the technology of micro-electronics. For this school, the main planning problems are the distribution of surplus populations, the filling of their time, since it is no longer filled by productive work, and the protection of

natural environments from over-use. The scenario tends to be accompanied by a socially conservative, or even reactionary, view of society. It pictures a society stratified by age, skills and gender and – though this is arguable – it is easy to identify such a 'micro-chip' society with a strong, centralised government, even a totalitarian one.

The actual trends of recent years can, however, be interpreted in a very different way. They include growing public participation in planning, starting well before the end of economic growth, in the 1960s, and largely arising out of public reaction against slum clearance and the indiscriminate destruction of old environments. In response to this, the government passed various measures to ensure that local authorities consulted public opinion about their planning programmes. These may easily be dismissed as mere tokenism, but the very existence of channels for participation reflects a more informed public, and also a planning profession that is more responsive to social needs. Active participation in planning, in the form of direct interventions in the environment, has increased, and is still increasing, with the help of inadequate but nevertheless very useful government grants. This includes the creation of community gardens, playgrounds and urban farms, which lead a precarious existence, sometimes in conflict with the authorities, but which are read as part of a widespread movement of 'greening the city'.

As public participation in planning grew, so did the trend towards conservation. The two things shared to some extent the same root: a feeling of loss as the urban environment was transformed. Powers to preserve buildings as monuments had always existed, but these were now greatly extended to include whole areas of traditional building, and also houses – though improvement grants for these were argued, not in terms of conservation, but simply in order to prolong the life of the housing stock. As architectural or historical preservation, conservation is quite unchallenging, the preserve of scholars and affluent landowners. But in other respects it can become quite a radical planning change: for instance, when it is used to prevent the dispossession of comparatively humble house-owners and small businesses by large-scale property redevelopment, or when it is viewed as part of a general movement to husband rather than destroy the earth's resources. The resources that are embodied in traditional buildings are not only material ones, but also non-material ones of skills and values that cannot be replaced.

Another planning trend may be described under the title of 'freedom to build'. Speaking literally, this refers to a school of anarchist thought in housing that puts the case for urban industrial populations to design and build their own houses, as vast populations in the developing world have traditionally done. The idea derives from the experience of John Turner and other architects in poor countries, and particularly from their squatter

settlements that present, superficially, an impression of low standards and utter chaos, but that are often in fact appropriate to the means and needs of their residents in ways that state-provided housing is not. What had always been a minority movement in Britain, where people were able to design and build their own houses through housing cooperatives, was now revived in a small way. More significant in terms of output, the housing association sector provided an alternative to council estates and houses for sale. Providing mainly for minority groups, it was able to be more sensitive to their needs than either of these two main wings of the housing market.

Together, these various trends were both a reflection of and encouragement to changes in the outlook of planning professions, and particularly of architecture. Public disillusionment with planning, and the particular case of high-rise housing, created a personal crisis for many architects and planners, who had wholeheartedly believed in what they had been doing. Architects who, unlike most planners, had the freedom to work in private practice, were able to react more flexibly. Using the strengthened machinery for improvement, conservation and housing co-ops, they were able here and there to work closely with local populations, interpreting their wishes to remain in their environments, and expressing them in built form. At the same time, in reaction to the inhuman scale and monotony of high-rise estates, a new school of 'neo-vernacular' design provided new estates that were decried by purist architects, but which were much more acceptable to the people who actually lived in them. These various strands, which were sometimes described as 'community architecture' were inspired by the belief that, in the terms of Ivan Illich, a profession should be 'enabling' rather than 'disabling': that is, its true function is to enable its clients to interpret and satisfy their needs, rather than imposing its own professional prescriptions upon them, as professions had come to do within the official planning system.

Such a change in attitude was a radical change in consciousness, which must be seen in the context of changing life styles and the emergence of alternative economies, which are one of the most significant things about British society in the last third of this century. New types of household emerged that were no longer centred on the nuclear family, or on the rigid division of home and work. Mainly young, relatively poor but independent people found that they could live together by combining resources and skills. Young professionals, who previously would have had much higher material expectations for themselves, now found it satisfying to work in local communities with which they identified personally. Thus their professional energy was directly channelled, instead of being funnelled through the structure of the state. For many of the individuals and groups in question, their way of life was the practical expression of their

beliefs: a new reverence for the planet, awareness of the cosmos, and personal humility, which were linked in their minds to struggles against violence and oppression throughout the world. Whereas Britain had once led the world in materialism, brute force and domination, these people now brought an opposite message of peace and creativity.

Since they were only a minority movement, they could not undermine established systems, of which planning was one; but they did pose some questions that were not easily answered. Thus their 'exchange economies' challenged the tax system, and their preference for small-scale, self determining groups challenged traditional forms of government. The search that many undertook for rural self sufficiency undermined the cherished assumption that cities are the most highly developed form of society. Their emphasis on personal relationships and their fusion of work and domestic life contradicted conventional planning assumptions that an efficient, scientifically planned society must depend on strictly quantified activities and ends. In all its many aspects, the 'alternative' movement, disorganised and chaotic as it was, challenged the materialist, determinist basis of the planning system.

It would be easier to dismiss the challenge were it not for the fact that planning was, in fact, in crisis. Not only were many of its aspirations failed or frustrated, but – more seriously – it had no fresh philosophy or programme for a period of social and economic change that was clearly going to rival that of the industrial revolution in its magnitude. At the time of writing, the future of British planning is very much in question, as is the future of British society. It is possible to take a pessimistic view, of a degenerating, impoverished society, all its institutions lapsing into repression. But it is also possible to take a more positive view, of a society where great changes are intelligently used as opportunities for redefining goals and values. Whether planning can devise strategies and goals for such changes is yet to be seen. An important task of the present is to derive understanding and wisdom from our past practices, and if possible to impart some of that understanding to others.

References

1 'Radical Alternatives', *The Architects' Journal*, 19 October 1977, pp. 727–67.
2 'Segal's first half-century in practice', *The Architects' Journal*, 7 April 1982, pp. 33–36.
3 Sherry Arnstein, 'A ladder of citizen participation', *Journal of the American Institute of Planners*, 35 (July 1969), pp. 216–24.
4 T.L. Blair, *The Poverty of Planning: Crisis in the Urban Environment*, Macdonald, London, 1973.
5 T.L. Blair, *The International Urban Crisis*, Paladin, St Albans, 1974.
6 Murry Bookchin, *The Limits of the City*, Harper and Row, New York, 1974.
7 Gerald Burke, *Townscapes*, Penguin, 1976.

8 Norman Dennis, *People and Planning*, Faber, London, 1970.
9 Norman Dennis, *Public Participation and Planners' Blight*, Faber, London, 1972.
10 Hassan Fathy, *Architecture for the Poor*, University of Chicago Press, Chicago, 1973.
11 Ivan Illich *et al*, *Disabling Professions*, Marion Boyars, London, 1977.
12 Jane Jacobs, *The Death and Life of Great American Cities*, Random House, New York, 1961.
13 Elaine Morgan, *Falling Apart: the Rise and Decline of Urban Civilization*, Souvenir Press, London, 1976.
14 Oscar Newman, *Defensible Space: People and Design in the Violent City*, Macmillan, New York, 1972.
15 Alison Ravetz, *Remaking Cities*, Croom Helm, London, 1980.
16 Andrew Rigby, *Communes in Britain*, Routledge and Kegan Paul, London, 1974.
17 E.F. Schumacher, *Small is Beautiful*, Blond and Briggs, London, 1973.
18 Geoff Scott, *Building Disasters and Failures: a Practical Report*, The Construction Press, Hornby, Lancs, 1976.
19 J.F.C. Turner and R. Fichter (eds.) *Freedom to Build*, Collier Macmillan, London, 1972.
20 Barbara Ward, *The Home of Man*, Penguin, 1976.
21 Colin Ward, *Tenants Take Over*, The Architectural Press, London, 1974.
22 Nick Wates, *The Battle for Tolmers Square*, Routledge and Kegan Paul, London, 1976.

9 Environment and values: the Islamic perspective

S. PARVEZ MANZOOR

The rapid deterioration of human environment is one of the most striking manifestations of the crisis of Western science and technology. It is, as has been argued so convincingly by Ravetz and Nowotny, a crisis of values. Whether one agrees or disagrees with the analysis of these two authors, one cannot ignore the inescapable conclusion that modern science and technology has provided us with a literal and physical capacity to completely *destroy* ourselves. The threat to the very abode of our terrestial sojourn is merely an indication of this capacity.

Can we, then, check this threat to our planet simply by introducing stricter legislation against pollution, industrial waste and nuclear spill? Can we reverse the degradation of our environment by adopting conservationist policies on both national and international levels? Or could it be that the whole ecological imbalance betokens the spiritual and teleological crisis of modern civilisation itself? Does it require fundamental revision of our own way of life, our cherished goals, indeed our very conception of ourselves and the world? These are the questions that I will be addressing in this essay. It is my conviction that within the context of environmental debate, the Islamic viewpoint has not only been unduly neglected but that Islamic traditions and values provide a very effective and comprehensive answer to the absurdities of our environmental situation.

The modern situation

Modern civilisation is characterised, above all, by its awesome mastery of the physical and natural forces which throughout human history have bedevilled man with distress and misery of every kind. No longer helpless before the capricious might of untamed nature, modern man, having already subdued his whole terrestrial milieu, is now casting his covetous glances at the stars. This unprecedented dominion over nature is a unique and singularly impressive feature of the modern, albeit Western, civilisation. Every other contemporary civilisation[1] tries to emulate the West in the acquisition of the tools of this fearsome mastery: Occidental science and technology. For the non-Western world, nothing, it appears, is too high a price to pay to the Faustian god of power who commands the unflinching obedience of the demiurge of science and technology. Political ideology, religious persuasion, cultural heritage and historical traditions are all willingly sacrificed at the high altar of modernity. The official technolatrous cult is, furthermore, sustained by a spurious faith that

prevails both within the corridors of political power and the ivory towers of intellectual respectability. Every contemporary society, thus, it would appear, is scrambling for the spoils of Western conquest of nature, unhampered by moral constraints of any kind.

Ironically, whereas the rest of the world is blinded by the dazzling display of Occidental might, the West itself is no longer sure of the fundamental moral forces that sustain the entire weight of the gigantic edifice of its civilisation. Faced with the enormity of the problems that confront the world today;[2] problems that defy technical, i.e. Western, solutions;[3] Western man is displaying every symptom of the failure of nerve. A heightened awareness of the sombre aspects of modern science, from its facile patronisation of a highly lethal weaponry to its imperious disregard for social responsibility; from the metaphysical *Angst* of dehumanized technological culture to the sheer impossibility of maintaining the wanton ethos of 'progress and meliorism' forever, have all cast an uncanny shadow of doubt not only on the teleological foundations of modern civilisation but equally on the ability of man to survive as a race on this planet.[4] The ominous foreboding of environmental calamity, perhaps the greatest peril facing mankind today, has also brought back the cardinal virtue of *temperantia* and the need for humility in scientific jargon.[5] In short, gone today is the illusory sense of dominion which man enjoyed during a short interregnum. Gone, certainly, is yesterday's confidence in the powers of Promethean man.

Ecological ethics and religious consciousness

Man as a creature, Lewis Mumbord once acutely observed, 'is never found in a "state of nature", for as soon as he becomes recognisable *as* man, he is already in a state of culture'.[6] Man's strivings to impose his will upon nature may therefore be construed as being essential to his constant struggle to remain in a state of humanity. The way he reacts with nature, seeking dominion over her or propitiating her with votive gifts, thus, mirrors man's very conception of himself and of the ultimate values he espouses. Without doubt, human environment, the part of nature man inhabits and fashions to meet his aspirations, reveals a great deal of a culture's teleology and its overall world-view. Ecological issues are, in the final analysis steeped deep in the moral and ethical consciousness of a culture: Ecology is a part and parcel of religious *Weltanschauung*.

Recently, with the gradual awareness of the degradation of global environment, the following questions have repeatedly been asked: In which way is the present state of ecological imbalance, to use the current expression, indicative of the spiritual rootlessness of modern culture?[7] What are the metaphysical and philosophical roots of the environmental attitude that has brought modern civilisation to the brink of disaster? Or,

more specifically, what is in the Western man's intellectual and spiritual heritage that distinguishes his view of nature, and concomitantly his environmental ethics, from those of preceding and other contemporary cultures? Is the depletion of natural resources and the deterioration of human environment merely the obverse side of the industrial society that has let out the genie of technological change and is now unable to control the unruly spirit?[8] Could the villain in the whole ecological drama be man himself who has bred too many of his own kind?[9] Perhaps, the root cause of our environmental predicament is simply that 'all ethics hitherto ... believed themselves to have to deal only with the relations of man to man'?[10]

A very provocative answer to these questions was provided by Lynn White Jr,[11] who put forward the thesis that the roots of our ecological problems are to be found in the Judaeo-Christian ethics. Man, in the Biblical tradition, White argued, is *above* nature. He is a special creation of God and has been commanded to have dominion over nature: 'to replenish the earth and *subdue* it: and have *dominion* over the fish of the sea and over the fowl of the air, and over every living thing that moveth upon the earth'.[12] Christianity, 'the most anthropocentric religion the world has seen',[13] the argument continues, sanctified man's conquest of nature and, in fact, was instrumental in the engenderment of natural and physical sciences. The emergence of science, technology, indeed the modern secular world, owes its rationale to the Biblical *Weltanschauung*: nay, it is an essential fulfilment of Christian commitment.[14] But, and here the argument changes into an indictment and marks the specific contribution of its author, by sanctioning man's unrestricted conquest of nature, Christianity, in reality, fostered an exploitative ethic. Thus Christianity, White believes, must take the blame for the environmental affliction of mankind because the roots of the present ecological crisis lay already in the first chaper of Genesis. Having acquired this insight, White was bold enough to plead for the modification of the so-called 'dominion ethics', whose misapplication has resulted in the present environmental débâcle, and replace them with what he called 'Franciscan conservatism'.[15]

Though White's paper stirred considerable debate, even controversy, what he said was, in essence, hardly original. White's assertion, that as opposed to the pantheistic religions, where nature is experienced from *within*, the monotheistic consciousness of a Transcendent Deity de-divinizes the world, thereby making nature available as an objective reality to be apprehended from *without*, merely restates one of the most basic insights of religious phenomenology.[16] Similar insights have been supplied by philosophy,[17] logic,[18] aesthetics,[19] psychology[20] or general theory of cultures.[21] Whatever the novelty of White's thesis (his main contribution, was not the annunciation of a new theory but the application of earlier

insights to the contemporary context of ecological crisis), there seemed to be unanimity on one point, namely, that environmental exploitation, or misuse, is a *monotheistic* problem and an aberration – or logical concomitant – of 'dominion ethics'. Recognizing the strength of White's argument and conceding that 'nature, as well as man, has rights',[22] Arnold Toynbee castigated 'the monotheistic disrespect of nature'[23] with the simple solution 'that the remedy lies in reverting from the *Weltanschauung* of monotheism to the *Weltanschauung* of pantheism, which is older and was once more universal'.[24]

Other indictments have been no less severe. The monotheistic crusade against the sin of *idolatry*, of nature worship, has also been dismissed as a Quixotian charge at the windmills because 'it is doubtful that any such thing as idolatry has ever existed to any significant degree outside the perceptions – or misperceptions – of Judaeo-Christian cultures'.[25] Quite the contrary, 'desacralised nature, *our* nature, lacking sacramental transparency, *has* become an idol, an objectivised reality held to be final and self-sufficient: the highest reality, the *only* reality'.[26] Nothing less than the whole prophetic tradition, from Abraham to Muhammad, stands accused for mankind's present ecological distress!

Another remarkable feature of the environmental controversy over the 'monotheistic debasement of nature' was that Islam – as usual – hardly figured in this discussion as if it were a religion on the moon and the living reality of one billion Muslims merely a statistical illusion. It was taken for granted that 'Islam, like Marxism, is a Judaeo-Christian heresy', and as such, it had hardly anything original to contribute.[27] As for those who did spare a thought or two to the flowering of science in 'Islamdom' during the Western Middle Ages, the anamolous fact was easily – and of course, erroneously – 'explained away' by contending that 'the main content and attitudes of Islamic science appear to derive solidly from Greek sources',[28] and that 'within the context of present discussion (monotheistic engenderment of natural sciences), the case of Muslim science must logically lead in a direction opposite to that in which it is commonly supposed to lead'.[29]

All this is of course irreverent nonsense. The whole subject of Islam's relationship with natural science still awaits proper enquiry – and cannot be entered upon here – but all the available evidence suggests that the scientific *Weltanschauung* of Islam was anti-classical.[30] If science in Islam did not lead to the same kind of development that transpired in the West, it is simply because it was never divorced from values.[31] Other, more tangible, factors, quite naturally, did contribute towards the decline of natural sciences in Islam but the main constraints were ethical.[32] In hindsight one could not regard this as merely unpropitious.

Without question, in the ongoing controversy, one recurrent theme of

which is the role of religious consciousness in the formation of environmental attitudes, the vantage-point of Islam deserves as much consideration as any other. There is no justification for assuming an identity of Qur'ānic and Biblical stance on the subject – without enquiry and comparison. Despite the common 'monotheistic' vocabulary (God, creation, man, history, revelation etc), the Qur'ānic statement on man's ultimate purpose, and hence his relationship with nature, differs not only in tenor and syntax but in substance as well from that of the Bible. Nature and ethics are, as a matter of fact, at the very core of Qur'ānic *Weltanschauung*. To infuse the natural world with transcendental (revealed) ethics is the main purpose of man according to the Qur'ān.

In fact, man's salvation or damnation ensues from his ability to assume moral responsibility in his natural milieu. So central is the Qur'ānic theme of the affinity of nature and ethics that even outsiders have not failed to notice it. For instance, Marshall G. Hodgson, a sympathetic (Christian) scholar of Islam and the author of the monumental *The Venture of Islam*, epitomized the quintessential dictates of Islamic consciousness as '*the demand for personal responsibility for the moral ordering of the natural world*'.[33]

The present ecological crisis has indeed made Islam a particularly relevant ethical tradition. Once blinded by the dazzling haze of modernity, countless number of Muslims are now, thanks also to the ecological hindsight of the once improvident Occidental culture, rediscovering their own spiritual roots. The whole philosophy of secular meliorism and its concomitant delusion of progress and prosperity forever appear patently irrelevant when viewed in the light of the Qur'ānic ethic of moral responsibility and moderation.[34] It is not accidental that Muslims intellectuals were among the very first who raised their voices against the abuse of nature which was being perpetrated in the name of science and progress.[35] In the coming years, Muslim thinkers will, I believe, make their voices increasingly heard on issues pertaining to environment and values. Their Islamic conscience, I believe further, makes them suitable partners in a debate which until recently has been an internal Western prerogative. At a time when the whole ethical tradition of monotheism is being reviled for leading us to the present environmental cataclysm, truth demands that monotheistic 'solutions' – even outside of Biblical tradition – be sought. I believe Islam possesses such a monotheistic solution to mankind's present ecological ills.[36]

Certain basic principles of Muslim environmental thinking may be delineated now – at least tentatively as the theme may be formulated in many different intellectual fashions – in the light of the fundamental values of Islam as identified in the 'Knowledge and Values' seminar held in Stockholm in September 1981.

Some metaphysical and philosophic principles governing the enrivonmental Ethics of Islam

Tawhīd

Every discussion of ethics in Islam must, of necessity, proceed from *Tawhīd* as it is the *sine qua non* of Islamic faith. 'In Islam, ethics is inseparable from religion and is built entirely upon it'.[37] Islam is, above everything, assertion of the certitude of *Tawhīd*: of the unity of God.[38] *Tawhīd* is thus the *metaphysical* and *theological* principle *par excellence* which gives the religion of Islam its unique profile and its distinctive morphology. The unitary principle of *Tawhīd* is also construed in Islam as a *teleological* axiom: the universe has been created by God who is also its final end.[39] As an *ethical* rule, *Tawhid* dictates the acceptance of God as the only source of all values: not to do so would lead one to *shirk*, the negation of *Tawhīd* – the cardinal sin in Islam. Within the tradition of Sufism, *Tawhīd* has also been experienced as the all-pervasive unity of the phenomenal world.[40]

Tawhīd, the paramount concept of Islam and the Islamic way of life, defies exact translation in other tongues. It has variously been rendered as 'monism', 'unicity' or even 'monotheism', but it is better rendered, keeping in mind its literal sense, as an act of unification or the assertion of unity.[41] Thus conceived, it inculcates a *psychological* and behavioural attitude that demands 'a relationship with the Only One that excludes a similar relationship with anyone else'.[42] Whatever a Muslim does, thinks or feels is motivated by this quest for unity. The identity of personal piety and ritual devotion, of theology and law, of politics and religion, of faith and deeds in Islam are all manifestations of the same all-pervasive principle of *Tawhīd*.

'The principle of *Tawhīd*, or the unization of God, the recognition of Him as one, absolute and transcendent', asserts a modern Muslim thinker, 'is also at the centre of the Muslim's curiosity regarding nature'.[43] In other words, the same unitary attitude that determines Muslim's theology, or philosophy or art also pervades his *epistemology*. 'The first principle of Islamic knowledge therefore is the unity of truth, just as the first principle of human life is the unity of the person, and the first principle of reality is the unity of God'.[44] Islamic epistemology is unreservedly and uncompromisingly holistic. Fragmented knowledge or reductionist epistemology would be a contradiction of terms in the Islam context.[45]

The doctrine of *Tawhīd* is forever inspiring Muslim thinkers to discover new facets of reality. Whether the subject be art,[46] economics,[47] sociology[48] or plain political dynamism,[49] *Tawhīd* directs a Muslim's vision to the perception of new vistas. A modern Iranian Muslim found in the worldview of *Tawhīd* the ultimate imperative to political action. He rebelled against tyranny and found martyrdom. His own manifesto reads:

'In the worldview of *tawhīd*, man fears only one power, and is answerable before only one judge. He turns to only one *qibla*, and directs his hopes and desires to only one source. And the corollary is that all else is false and pointless - all the diverse and variegated tendencies, strivings, fears, desires and hopes of man are vain and fruitless. *Tawhīd* bestows upon man independence and dignity. Submission to Him alone - the supreme norm of all being - impels man to revolt against all lying powers, all the humiliating fetters of fear and greed'.[50]

For Muslim ethic, the concept of *Tawhīd* is indispensable. Whether the issue be ecological, economic or merely technical, the application of the principle of *Tawhīd*, the assertion of God's unity, by reminding one of the ultimate goal of every human effort, *ethicises* the issue. *Tawhīd* is thus the very process of *Islamisation* by which the natural world is brought under moral control; nature and ethics are integrated and the unity of intent and action, purpose and goal, means and ends is achieved.

Khilāfa and Amāna (Stewardship and trust)

One of the grandest themes of Qur'ān is the creation of man. It is alluded to either *philosophically* in a symbolic language or *biologically* employing the idiom of natural sciences.[51] Philosophically, the first Qur'ānic assertion is that of the purpose, of the meaning, of human life. The purpose, which imposes absolute obligations for the conduct of man,[52] is the fulfilment and realisation of divine will. As the supreme creation of God, being His masterpiece, man has been endowed with all the faculties essential to his special mission. First of all, he is a *moral being* and as such, 'he is a sort of cosmic bridge through which the divine will, in its totality and especially the higher ethical part of it, can enter space-time and become actual'.[53] Furthermore, gifted with discursive intellect (*'Aql*) and the power of conceptualisation,[54] man has also been given divine guidance in terms of moral imperatives - the revelation of God's will in prescriptive form. In short, he is the highest of God's creation, a theomorphic being,[55] bearing in himself the spirit of God,[56] before whom even the angels must prostrate.[57]

Nature is man's testing ground. Man is enjoined to read its 'signs'.[58] Nature has therefore been created both orderly and knowable. Were it not so, were it unruly, capricious and erratic, it would be ' "ship of fools" where morality is not possible. Such creation would be a cruel and senseless act on the part of a malevolent deity'.[59] Were it not knowable, it would be both oppressive and degrading for man who would humble himself before its slightest whim. It would then be 'a veil which hid the face of God', to use a felicitous Sufi expression. Nay, both the orderliness of nature and its amenability to rational enquiry are essential for morality.

Man has, of his own occord, accepted nature as a trust (*amāna*) and a

theatre for his moral struggle. Heavens, earth and mountains refused to assume this responsibility which man took upon himself voluntarily.[60] By accepting the trust man, no doubt, showed ignorance and hubris[61] but also his willingness to serve God's purpose. Trust is a mutual commitment: God too, by entrusting man with this responsibility, that of taking control over nature, expressed his confidence in the ability of man. 'Man therefore occupies a particular position in this world. He is at the axis and centre of cosmic *milieu*, at once the master and custodian of nature'.[62]

Notwithstanding this exalted status, man is but the deputy of God possessing no authority save that of a steward.[63] As befits his position, man cannot be the arbiter of his conduct: he must defer it to the judgement of his sovereign. Denial of absolute sovereignty to man is tantamount to investing him with moral responsibility. As any kind of responsibility can, in the last analysis, only be personal, it is a natural corollary of man's acceptance of trust that he be born free and innocent. Man is thus in the Islamic tradition a creature unsullied by any ontological flaws. He bears no stigma of any 'original sin' that would make him a victim of his own humanity. From the Muslim standpoint, a 'fallen' humanity is commensurable neither with Divine justice nor with human dignity.[64]

The entire Islamic rationale for an ecological ethics rests firmly on the Qur'ānic notions of *Khilāfa* (man's vice-gerency) and *Amāna* (trusteeship).[65] Nature, being an estate belonging to God, has been given to man merely as a trust and man's right 'to dominate over nature (is) only by virtue of his theomorphic make-up, not as a rebel against heaven'.[66]

Sharī a (the ethics of action)

There is no division of *ethics* and *law* in Islam. The ultimate consequence of man's acceptance of trusteeship is the arbitration of his conduct by Divine judgement. Perceived thus as a preparation for the final trial, every human act, humble or grand, public or private, becomes charged with legal consequences. All contradictions of *internalised* ethics and *externalised* law, of concealed intentions and revealed actions are resolved in the all-embracing actionalism of *Sharī'a* because it is both a *doctrine* and a *path*.[67] It is simultaneously a manifestation of divine will and that of human resolve to be an agent of that will. It is *eternal* (anchored in God's revelation) and *temporal* (enacted in human history); stable (*Qur'ān* and *Sunnah*) and dynamic (*Ijmā* and *Ijtihād*); *Dīn* ('religion') and *Mu'āmalah* (social interaction); Divine gift and human prayer all at once. It is the very basis of the religion itself: to be Muslim is to accept the injunctions of *Sharī'a*.

Sharī'a or Law, rather than theology, has been the main Muslim contribution to human civilisation.[68] It ought not to be a matter of surprise that for a 'practical' community such as that of the Muslim's existential

imperatives (Law) rather than moral or teleological speculation (theology) should be the matter of paramount concern. Muslim thinkers have rarely addressed themselves to the problems of *good* and *evil* in the *abstract*.[69] Human experience shows that these notions are notoriously difficult to define theoretically. Islam shows that what cannot be defined intellectually, may, with Divine guidance and human effort, be resolved in terms of *action*. *Sharī'a* views every life-situation as concrete and unique and a matter of decision in terms of action. Issues which cannot be perceived in the thought-categories of *good* and *bad*, can be reduced to the categories of *halal* (licit, proper, prescribed) and *harām* (illicit, improper, proscribed) acts.[70]. The moral perspective of *Sharī'a* demands 'doing right' rather than 'being good': it is thus not a soteriological *ontology* but a moral *existentialism*. In some sense, Muslim consciousness and Sartre are in agreement that man is 'condemned to be free', to make a choice, to act. But whereas the atheistic existentialism of Sartre cannot be redeemed by any kind of ethics, *Sharī'a* brings the whole spectrum of human life under the jurisdiction of absolute moral judgement because of its firm anchorage in the revelation of God – the source of all good and the goal of every human endeavour.

Sharī'a is also the *methodology of history* in Islam. By its application temporal contingencies are judged by eternal imperatives, moral choices are transformed into options for concrete action and ethical sentiment is objectified into law. It is in fact the *problem-solving* methodology of Islam *par excellence*. Any theoretical Muslim thinking, as for instance our search for an environmental ethics, must pass through the objective framework of *Sharī'a* in order to become operative and be part of Muslim history. *Sharī'a* thus provides both the ethical norms and the legal structure within which Muslim state(s) may make actual decisions pertaining to concrete ecological issues. And not only is *Sharī'a* indispensable for decision-making in an Islamic context, its moral realism also provides excellent paradigms for theoretical discussion of Islamic ecological philosophy. Non-Muslims too, in my opinion, should benefit from the resuscitation of *Sharī'a* in Muslim environmental thinking.[71] *Sharī'a* works on universal postulates (for Muslims they are the axioms of divine revelation), has a very stringent and evolved methodology and its answers are given in terms of a strategy for action; all this gives it universal validity.

The main contribution of *Sharī'a*-consciousness, notwithstanding its practical utility, is, however, that the whole life of moral man is amenable to right and wrong actions, the ultimate criteria of which have been determined by God Himself. To replace Divine Law with man-made stipulations causes only human misery as our ecological woes too flagrantly manifest.[72]

'Adl and I'tidal (justice and moderation)

Islamic eschatological vision is determined by the tremendous, awesome consciousness of 'God as the Judge'. Justice, the supreme attribute of God, is also synonymous with Order and Equilibrium. Indeed, Divine perfection, as Muslims perceive it, is manifested in the very harmony and balance of the universe.[73] It is also reflected in God's apportioning to everything its proper measure.[74] Muslims laud it as the manifestation of Divine mercy and hold that 'Divine Justice is the guarantor of the Muslim's dignity and self-esteem and is the lock on the door barring human complacency in matters moral'.[75]

In Arabic, the language of revelation, metaphysics and philosophy of Islam, the words for justice (*'adl*) and moderation, temperance, balance, equilibrium, harmony (*i'tidāl*) are semantically and etymologically kindred.[76] Muslim societal ethics, the very basis of society itself, is but a quest for equilibrium, and hence felicity, with God, nature and history. It entails submitting oneself to the will of God, accepting the mandate of trusteeship and striving to be a moderate community (*ummah wastah*).[77] Historical testimony will confirm the veracity and felicity of Qur'ānic designation.[78] The goal of justice, Muslim consciousness affirms, is reached by treading the path of moderation.

The moderation of Islamic ethics stems from its life-affirmation. Whereas some universal religions, such as Christianity and Buddhism, contend that their ideals are realisable only within the precincts of special, extra-societal, sacerdotal institutions like the Church or the *Sangha*, Islam holds that society is necessary for morality and that the demands of religious commitment can best be, indeed must be, approximated within the social system of a *lay community*, the *Muslim Ummah*. Institutionalised monkery and excessive asceticism are repugnant to the temperate and societal ethos of Islam. 'The Prophet has directed his followers against overextended rituals of worship, against celibacy, against exaggerated fasting, against pessimism and the morose mood. He ordered them to break the fast before performing the sunset prayer, to keep their bodies clean and their teeth brushed, to groom and perfume themselves and wear their best clothes when they congregate for prayer, to marry, to take their time to rest and to sleep and recreate themselves with sports and arts'.[79] 'To enjoy the bounties of God's provisions but not to over-indulge', the well-known Qur'ānic dictum, is indeed forever on the lips and in the hearts of Muslims.[80] The concepts of *Ijmā'* (general consensus), *Istihsān* (preference for the better) and *Istislāh* (public welfare), the dynamic principles of *Sharī'a*, all have moderating influences on Muslim society. The symmetry of Islamic arts,[81] 'the immediacy of the Islamic way of life',[82] 'the harmony of contemplation and action'[83] are all, likewise, felicitous expressions of the fundamental Islamic ethic of justice and moderation.

The adoption of the ethic of moderation may, it is hoped, save Muslim societies from the ills of wanton consumerism and the senseless squandering of human and natural resources which is universally going on in pursuit of an illusory meliorism.[84]

The notion of *'Adl*, along with its corollary *I'tidāl*, also constitutes the second general principle of Islamic epistemology. The harmony of knowledge and values that is the ultimate aim of Muslim morality is best attained by the balance of values themselves. If knowledge is not to be fragmented, values must also be harmonised against each other. Justice and moderation, moreover, may also be construed *dynamically* as the societal quest for equilibrium. The unity of knowledge, harmonisation of values and search for justice, thus, Islamic life-affirmation instinct insists, must be located and actualised within the moderate ethics of a lay society. Islamic ethics, however, is not merely of this world. Despite its utmost respect for the sanctity of life, family, society, the ultimate value in Islam is neither *material*, nor *economic* but *moral*.[85] To work for the establishment of the 'Kingdom of God' on this earth is the goal of Muslim morality, but to hope for eternal bliss in the hereafter is the essence of Islamic faith itself.

We may reiterate that the attainment of equilibrium, viewed both statically and dynamically, constitutes the Muslim answer to the problem of ecological ethics. The path of ecological justice, Islam shows, is paved with the ethical restraints of moderation.

The sacremental earth

So far, our bid for the formulation of Islamic ecological ethics has entailed a delineation of the broad parameters of the ethical philosophy of Islam itself. It has been pointed out that the general metaphysics of ethics in Islam not only offers an excellent values-paradigm from which a relevant environmental ethic can be elicited, but that a concern for the ethical potentialities of the natural *milieu* of man is essential to the Qur'ānic worldview. In conclusion we shall now examine 'the desacralization of nature' thesis from the vantage-point of Islam and try to answer the question raised in the beginning of this discussion, namely whether there exists a monotheistic – Islamic – ethic that provides a satisfactory answer to the current ecological distress, or whether the adoption of the pantheistic worldview alone, as pleaded by Arnold Toynbee, can deliver mankind from the imminent environmental disaster?

Despite its obvious affinity with the two other monotheistic faiths of Islam and Judaism, Christianity differs from them in many radical ways.[86] To take but a few points relative to our theory: the Hebrew story of *creation*, for instance, is transformed in Christianity into the doctrine of *'fall'*. Creation thus appears to the Christian mind as 'fallen' and *nature*

opposed to *grace*.[87] Salvation then is the humbling of nature by the miraculous; the intrusion of the supernatural in history.[88] Moreover, the nearest thing in the physical universe that reflects the miraculous is man and holiness exists only in man-made environment: 'In the Christian view it was not emanation from the earth but ritual that consecrated the site; man not nature bore the image of God and man's work, the hallowed edifice, symbolised the cosmos'.[89] Nature thus devoid of God's presence and grace may justifiably be 'tortured', i.e. subjected to scientific exploitation.[90] The distinction of subject and object so essential to the scientific enquiry, the secularisation of the world and the environmental degradation, if we accept this kind of reasoning, are all due to Christianity.[91] In short, Christianity achieved not only a *de-divinisation* of the world (for such a conception of the world is incumbent upon both Islam and Judaism) but its *de-sacralisation* as well. The disenchanted, secularised world that heralded Christian victory is thus *profane*: unredeemed and devoid of any sacramental, symbolic significance.[92]

Islamic view is very different. A transcendent god does not necessitate debased creation: *de-divinisation* need not imply *de-sacralisation*. Indeed, Islam holds that 'there is no such thing as a profane world. All the immensity of matter constitutes a scope for the self-realisation of the spirit. All is holy ground. As the Prophet so beautifully puts it: 'The whole of this earth is a mosque" '.[93] Nature, like the Book of Revelation, is full of signs (*āyāt*). To know and decipher these portents constitutes Divine service (*'Ibāda*). In fact, Muslim theologians claimed, nature has no *meaning* without reference to God: without Divine purpose it simply does not exist.[94] The inseparable link between man and nature in Islam is found in the Qur'ān itself. Islamic revelation is a Book, a path of knowledge, certainty and judgement. Unlike Christianity which asserts that God Himself entered cosmos (and then profanes the world!), Islam, forever conscious of the Transcendence of the Creator, holds that Knowledge, Guidance and Judgement (names of the Qur'ān) have been revealed in history. Nature has thus been made amenable to the discriminatory judgement of Divine will, and man, the instrument of Divine purpose, has a mandate – and responsibility – to treat nature as a *trust*.

Within the Islamic perspective then, the debasement of nature by man leads to his own debasement and amounts to a revolt against the Creator. In the early days of Islam, this environmental ethic permeated the entire Muslim society, as can be seen from such products of Muslim technology of that era as irrigation schemes, the physical layout of classical Islamic cities like Fez, Sana'a and Isfahan, and the arts and crafts of that age. In fact, the Muslim respect for nature is so deep that scholars like Hossein Nasr have argued that the development of technology under Islam was

deliberately stifled when technology becomes a threat to the natural environment.

For the Muslim World, the answer to the contemporary environmental predicament lies in wholeheartedly going forward to the environmental ethic of Islam; in giving a practical shape to the environmental dictates of the *Sharī'a* by producing legislations in such areas as pollution, conservation and urbanisation, and in abandoning the way of the West and returning to the environmentally conscious traditions and lifestyles of Islam.

However, as the dominant civilisation the West too must now abandon its cherished goals of unlimited technological growth and overconsumption, and change its basic conception of man and nature. Here the world-view of *tawhid*, the concepts of *khilafa* and *amana*, the all-encompassing ethical practicality of the *Sharī'a* have a great deal to teach and a major role to play in alleviating the spiritual and teleological crisis of Western civilisation. One does not have to be a Muslim to benefit from such teachings.

Long before any furore of ecological concern questioned the validity of the dominant Western growth values and accused Christianity of profaning the world and propagating the ethics of dominion over nature, a Muslim thinker pleaded to Western conscience in these incomparable words: 'the great point in Christianity is the search for an independent content for spiritual life which, according to the insight of its founder, could be elevated, not by the forces of a world external to the soul of man, but by the revelation of a new world within its soul. Islam fully agrees with this insight and supplements it by the further insight that *the illumination of the world thus revealed is not something foreign to the world of matter but permeates it through and through*'.[95]

References

1 The entire complex issue of the contemporaneity of different civilisations still awaits a satisfactory theoretical approach. It has even been argued that at a given moment of history, there exists, properly speaking, only one civilisation. Inasmuch as the modern civilisation is Western, it is doubtful, the argument continues, whether there exists any such entity that may be described as a contemporary civilisation *other than* Western rather than *a degree of it*.

2 For a very succinct, and yet felicitously comprehensive, statement on what is perceived to be 'world *problematique*', see: Ziauddin, Sardar: *The Future of Muslim civilisation*, London, 1979, pp. 78–90.

3 Though traditional cultures did not make any distinction between the technical and the artistic sides of man (The Greek word '*Tekhne*', like the Arabic one '*San'ah*', used profusely by Ibn-Khaldun, denoted both industrial production and 'fine' art), the modern civilisation takes a narrow – amoral, aesthetically

neutral – view of technology. It is however quite telling that for a majority of people, the West is synonymous with the technological. Technique, anyhow, is not morally neutral: it simply refuses to tolerate moral judgements. 'Technique never observes the distinction between moral and immoral use. It tends, on the contrary, to create a completely independent technical morality' (J. Ellul, *The Technological Society*, New York, 1964, p 97). The immorality of technology is its amorality.

Another view has it that strictly speaking there are no 'technical' solutions as every solution requires human judgement and arbitration. In fact technique itself is an 'illusion'. (See: William Barrett, *The Illusion of Technique*, New York, 1978. Though the work is written from a purely pholosophical – existentialist – perspective and seeks to demonstrate the inevitability of human freedom, it has a lot to recommend it. It purports to be, according to the subtitle, 'A search for meaning in a technological civilisation'.)

4 Besides the works by Z. Sardar cited above, two very cogent indictments of modern culture need mentioning: T. Roszak, *Where the Wasteland Ends*, New York, 1972; and S.H. Nasr, *The Encounter of Man and Nature*, London, 1968 (later reprinted as *Man and Nature*, London, 1976).

5 Recently (January 1982), a seminar was held in Riyadh, jointly sponsored by IFIAS (International Federation of Institutes for Advanced Studies, Stockholm) and the University of Riyadh, the very theme of which is revealing: 'Nature to Man's Rescue'! The irony inherent in this statement, whether intended or not, however, must not be overlooked. Man's conjugal relationship with nature, it appears, has moved back a full circle. Though no longer compelled to propitiate her with human sacrifice, modern man is, nevertheless, reverting to a more humble posture of apprenticeship!
Cf. also Lynn, White, Jr: 'The Iconography of *Temperentia* and the Virtuousness of Techology', in T.K. Rabb and J.E. Seigel (eds.), *Action and Conviction in Early Modern Europe: Essays in Memory of E.H. Harbison*, Princeton, 1969, pp. 197–219. Similarly, E.F. Schumacher pleads in the concluding statement of his popular book, *Small is Beautiful*, London, 1973, for the resuscitation of the Four Cardinal Virtues – *prudentia*, *justitia*, *fortitudo* and *temperentia*. (The Islamic counterparts would be *hikma*, *'adl*, *sabr* and *i'tidāl*.)

6 Lewis, Mumford, *Technics and Human Development* (*The Myth of the Machine*, vol. I), New York, 1967, p. 46.

7 Nasr, *op. cit.*

8 Barry Commoner, *The Closing Circle*, London, 1972.

9 Paul R. Ehrlich, *Population, Resources, Environment*, New York, 1970.

10 Albert, Schweitzer, *Out of my Life and Thought*, New York, 1933, p. 188.

11 Lynn, White, Jr, 'The Historical Roots of Our Ecological Crisis', in *Science*, 155 (10 March 1967), pp. 1203–7. Later reproduced in David and Eileen Spring (eds.) *Ecology and Religion in History*, New York, 1974, pp. 15–31.

12 The Bible: Gen. I: 28. Cf. also: *Al-Qur'ān*, 45:13; 'And (He) hath made of service unto you whatsoever is in the heavens and whatsoever is in the earth; it is all from Him. Lo! herein verily are portents for people who reflect' (Pickthall's translation).

The tenor of the Qur'ānic statement is very different from the Biblical one. Man here is not given the mandate to subdue nature but his dominion over

nature is adduced as a sign of God's favour and nourishment for contemplation.

13 White, Jr, *op. cit.*, p. 24. (All our citations of White's paper are from the reprint in *Ecology and Religion in History*.)

14 This view has been readily, almost too readily in our opinion, accepted by modern thinkers. The subject-object dichotomy which is idiosyncratic of modern psyche – and essential to scientific thinking – is believed to be 'a direct legacy of the Christian distance from the world' (C.F. von Weizsäcker, *The History of Nature*, Chicago, 1949, p. 190). Some Christian theologians have even responded to the secularisation of the world in a spirit of jubilation and promise. Cf. for instance, Harvey, Cox, *The Secular City*, New York, 1966.

These facile notions of Christian origin of modern science have been forcefully challenged – on empirical grounds – by J. Ellul, who questions: 'The restoration (after the fall of Rome), under Christian influence, of an active civilisation – methodical, exploiting the riches of the world as a gift given by God to be put to good use? Not at all. The society which developed from the tenth to the fourteenth century was vital, coherent, and unanimous: but it was characterised by a total absence of the technical will. It was "a-capitalistic" as well as "a-technical"' (*op. cit.*, p. 34).

15 White, Jr, *op. cit.*, pp. 28–31.

16 The recognition of typological differences between the prophetic, transcendentalist, historicising, "Western' religions on the one hand, and mystical, immanentalistic mythologising, 'Eastern' ones on the other, is basic to any modern textbook on the phenomenology of religions. Muslims too have been cognisant of these differences long before the insights of modern phenomenology were available to them. Cf. M. Iqbal, *The Reconstruction of Religious Thought in Islam*, London, 1932 (p. 124 f. Our reference is from the reprint in Lahore, 1971.)

17 Cf. Nietzsche's designation of his fundamental pair of opposites as the *Apollonian* and the *Dionysian*. (In his *The Birth of Tragedy*.)

18 Erich, Fromm, *The Art of Loving*, London, 1957, p. 55 ff. Fromm distinguishes between two kinds of 'logic'. The one, according to him, is 'Aristotelian' and the other 'paradoxical'. The latter predominates in 'Eastern' thinking and is also found in modern dialectical philosophy of Hegel and Marx.

19 Students of art history are familiar with the distinction, posited first by W. Worringer, between *abstract* and *organic* form. See W. Worringer, *Abstraktion und Einfuhlung*, 1908. Oswald Siren, the well-known Swedish scholar of Chinese art, perceives the differences in Greek and Chinese artistic traditions as due to the greater sensitivity of the former to *form* (perceived from without) and of the latter to *rhythm* (experienced from within). See his *Rhythm and Form: Essentials in Art*, London, 1920.

20 The Theory of Psychological Types is essential to Jungian psychology. Jung's basic division is between *introvert* (subject-centred) and *extrovert* (object-centred) human types. Cf. his *Psychologische Typen*, Zürich, 1921.

21 Cf. F.S.C. Northrop, *The Meeting of East and West*, New York, 1946. Northrop's typology of Eastern and Western cultures presumes a dichotomy of *theoretical* (inferred *a priori*) and *aesthetic* (immediately apprehended) modes of perception of the real.

22 Arnold Toynbee, 'The Religious Background of the Present Environment

Crisis', *International Journal of Environmental Studies*, 3 (1972). (Reprinted in *Ecology and Religion* . . ., p. 147.)

23 *Ibid.* p. 145.

24 *Ibid.* p. 148.

25 Roszak, *op. cit.*, p. 103.

26 *Ibid.*, p. 124 (his italics).

27 White Jr, *op. cit.*, p. 23.

28 James, Barr, 'Man and Nature: Old Testament and the Ecological Controversy', in *Bulletin of the John Rylands Library*, 55 (autumn 1972), pp. 9–32. (Reprinted in *Ecology and Religion* . . ., p. 52.)

29 *Ibid.* p. 53.

30 M. Iqbal, *op. cit.*, pp. 128 ff.

31 This is the main verdict of S.H. Nasr's studies of Islamic Science. Cf. his *Science and Civilisation in Islam*, Harvard, Mass., 1968; or his more recent *Islamic Science*, London, 1976. A Western reviewer has, however, accused Nasr – ungraciously we may add – of 'making too great a virtue of necessity': J.G. Ford in his reivew of Nasr's *Islamic Science*, in *Gazelle Review*, 4 (1978), p. 73.

32 W. Hartner, 'Quand et comment s'est arrête l'essor de la culture scientifique dans l'Islam?', in R. Brunschvig and G.E. von Grunebaum (eds.), *Classicisme et déclin culturel dans l'histoire de l'Islam*, Paris (new edition), 1977, pp. 319–37.

33 G. Hodgson, Marshall, *The Venture of Islam*, vol. II, Chicago, 1974, p. 337. Christian conscience, according to the same author, produces 'the demand for *personal responsiveness to redemptive love in a corrupted world*' (his italics).

34 Cf.: *Altaf Gauhar, Translations from the Quran*, Lahore, 1975, pp. 24 ff. The author's whole indictment of modern, secular civilization – and his personal discovery of the Qur'ān – takes shape within the context of ecological dismay.

35 Besides S.H. Nasr, other Muslim thinkers who have addressed themselves to the problem of modern scientific culture, have discovered in Islam a tradition particularly congenial to ecologial harmony. Cf. for Instance, Ziauddin, Sardar, *op. cit.*, as well his earlier *Science, Technology and Development in the Muslim World*, London, 1977. Cf. also, S.W.A. Husaini, *Islamic Environmental Systems Engineering*, London, 1980. Husaini's attempt to elicit environmental thought from Islamic sources forced him to trek the whole terrain of Islamic intellectual tradition – for such is the ubiquity of environmental concern in Islam. Cf. our review of Husain's book in *The Muslim World Book Review*, vol. I, no. 4 (1981), pp. 13–16..

36 It is fair to point out that in our opinion Christianity does not bear the blame for our environmental problems. It is the divorce of Christian ethics from the pursuit of knowledge, in fact what is known to be the age of 'rationalism' that ushered us in the era of environmental degradation. Of course, inasmuch as Christianity instituted a separation of Church and State – of moral and practical world – it is guilty of some sort for our ecological problems, even though it is so only by *default*.

37 *Isma'īl R. Al-Fārūqī:* 'On the Metaphysics of Ethics in Islam', *Listening: Journal of Culture and Religion*, vol. 14, no. 1 (1979), p. 25.

38 Indeed, such is Muslim awareness of the unity of God that the term 'Godhead'

is not suitable in an Islamic context because of its trinitarian connotations. Tawhid, thus, is not the assertion of the unity of Godhead, as some thinkers have stated, but of the unity of God.

39 *Al-Qur'ān*: 92:13, 53:42, 96:8, 2:156, 57:3, etc.

40 The Sufis, or Islamic mystics, despite their doctrine of *wahdat-al-wujūd* were not pantheists as has often been asserted, but were witnesses to the unity of God (*wahdat-ash-shuhūd*). This very delicate subject does not fall within the purview of this article, however, and we will be content to list just one Western work whose author claims that 'the term *wujud* which is usually translated as "being", "existence", means basically "finding", "to be found", and is thus more dynamic than mere existence': M. Molé,, *Les mystiques musulmans*, Paris, 1965, p. 61.

41 Grammatically *Tawhīd* belongs to the pattern of verbal noun (*taf'īl*) from the second verb form (*fa''la*) and signifies an act.

42 M.N. Siddiqi, 'Tawhid: the Concept and the Process', in Khurshid Ahmad and Z.I. Ansari (eds.), *Islamic Perspectives: Studies in Honour of Sayyid Abul a'la Mawdudi*, Leicester/Jeddah, 1979, p. 17.

43 Isma'īl R. Al-Fārūqī, *Islam and Culture*, Kuala Lumpur, 1980, p. 16. This essay has later been incorporated into Salem Azzam (ed.), *Islam and Contemporary Society*, Lonndon, 1982. All citations of this study, however, are from the Kuala Lumpur edition.

44 Al-Fārūqī, 'On the Metaphysics . . ., p. 25.

45 Generally speaking, epistemological Aristotelianism is lacking even in modern Muslim thought. Ziauddin Sardar and Husaini's books (*op. cit.*) are good examples of holistic thinking in contemporary literature. Cf also n 35 above.

46 For the significance of *Tawhīd* in Islamic visual arts one may consult numerous writings of T. Burckhardt, S.H. Nasr and I.R. Al-Fārūqī. Cf. also Lois L. Al-Faruqi: 'Islam and Aesthetic Expression' in *Islam and Contemporary Society*, *op. cit.*, pp. 191–212.

47 Cf. S.N.H. Naqvi, *Ethics and Economics*, Leicester, 1981.

48 Ali Shari'ati, *On the Sociology of Islam*, tr. Hamid Algar, Berkeley, 1979.

49 *Ibid.*

50 *Ibid.*, p. 87.

51 The scientific terminology of the Qur'ān with respect to human reproduction has been studied by Maurice Beaucaille, *The Bible, the Qur'ān and Science*, Indianapolis, 1978, and *What is the Origin of Man*, Paris, 1982.

52 *Al-Qur'ān*: 51:56, 17:23, 12:40, 2:21, 23:32, 20:14, 21:25, 29:56.

53 *Al-Fārūqī*, 'On the Metaphysics . . .', p. 27. The sufi position is expressed thus by S.H. Nasr: 'The purpose and aim of creation is in fact for God to come "to know" Himself through His perfect instrument of knowledge that is the Universal Man'. *Man and Nature*, p. 96.

54 *Al-Qur'ān*: 2:31.

55 Cf. the well-known *Hadīth: Khalaqa 'llāma'* āla sūratihi (God created Adam in His form). Muslim tradition warns, however, that it is not to be understood in an anthropomorphic sense.

56 *Al-Qur'ān*: 32:9.

57 *Ibid.*, 2:34, 20:116.

58 *Ibid.*, 41:53. Cf. also, S.H. Nasr, *An Introduction to Islamic Cosmological Doctrines*, Harvard, Mass., 1964, pp. 1–22.

59 *Al-Fārūqī, Islam and Culture*, p. 28.
60 *Al-Qur'ān*: 33:72.
61 *Ibid.*
62 Nasr, *Man and Nature*, p. 96.
63 The function of Islamic state, or of its titular head *Khalīfa*, is not, according to *Sharī'a.* to pass legislation but to enact and execute what has already been ordained by God.
64 Cf. *Al-Fārūqī*: 'Indeed, to claim that man is "fallen" as the doctrine of 'original sin' proclaims, is to impute to god the incapacity of creating a creature capable of fulfilling His own will, or the mediocrity of winning a battle against a strawman of His own creation' (*Islam and Culture*, p. 21). Cf. also the same author's: *Christian Ethics*, Montreal, 1962, pp. 193–222.
65 For similar notions in Christianity, see René Dubos: *A God Within*, New York, 1962, especially the chapter entitled 'Franciscan Conservatism versus Benedictine Stewardship'.
66 Nasr, *Man and Nature*, p. 96.
67 Etymologically, the word signifies a path leading to water, i.e. salvation.
68 H.A.R Gibb, *Mohammedanism* (newer edition reprinted under the title of *Islam*), Oxford, 1949. Our reference is from the paperback edition, Oxford New York 1972, p. 60.
69 Cf. *Iqbal, op. cit.*, pp. 176 ff, for internal Islamic debates over the methodology of *Sharī'a.* In his opinion 'the spirit of the acute criticism of Malik and Shafa'i on Abu Hanifa's principle of Qiyas, as a source of law, constitutes in reality an effective Semitic restraint on the Aryan tendency to seize the abstract in preference to the concrete, *to enjoy the idea rather than the event*' (italics added).
70 In fact, there are five categories of action that define the whole spectum of *Sharī'a* dynamism: *Halāl* (approved), *Mandūb* (recommended), *Mubāh* (indifferent), *Makrūh* (reprehensible) and *Harām* (forbidden).
71 S.W.A. Husaini has tried to synthesize the derived rulings of *Sharī'a* with the scientific knowledge available to us in the case of *Harīm* (the reserved and protected open space around a water source) (*op. cit.*, pp. 72–91).
72 S.H. Nasr attributes the weakening of Christian influence and the consequent rise of secular materialism to the absence of *Sharī'a* in Christianity. (*Man and Nature*, pp. 133, 135.)
73 *Al-Qur'ān*: 67:3–4; 36:39.
74 *Ibid.*, 25:2; 54:49.
75 *Al-Fārūqī*, 'On the metaphysics . . ., p. 41.
76 A similar relationship exists between the pair 'equity' and 'equilibrium' in the English language.
77 *Al-Qur'ān*: 2:143: 'Thus have We made of you an *Ummah* justly balanced, that ye might be witnesses over the nations . . .'
78 The mean to which the Qur'ān refers has been construed by the Muslims both in geographical as well as metaphysical terms. Not only does the Islamic world form a middle zone between the 'Western' (Judaeo-Christian) and 'Eastern' (Asiatic) religions, the ethics of Islam too falls in the middle of the two extremes of mortifying asceticism and hedonistic libertinism.
79 *Al-Fārāqī*, 'On the metaphysics . . .', p. 38.
80 *Al-Qur'ān*: 7:3.

81 Symmetry is essential to Islamic design. There have been numerous attempts to see in the symmetry of the geometric pattern of Islamic art a Muslim visual counterpart to the doctrine of *Al-Tawhīd*. The well known art historian Richard Ettinghausen, for instance, considers 'the general harmony, balance of parts and perfection of the whole composition', ubiquitous in all forms of Islamic art, as 'the most important Islamic element'. ('Decorative Arts and Painting', in J. Schacht and C.E. Bosworth (eds.) *The Legacy of Islam* (second edition), Oxford, 1974, p. 284.)

82 J. Berque, *The Arabs*, London, 1964, p. 38.

83 S.H. Nasr, *Islam and the Plight of Modern Man*, London, 1975, pp. 67–80.

84 It would not be too far-fetched to see in the recent Iranian revolution – whatever one's political affinity – a total, vehement, even violent rejection by a Muslim people of the whole ethos of modernity and all that it stands for.

85 Islam is not *materialistic* like Marxism, nor is it other-worldly like certain forms of monastic Christianity and Buddhism, but a this-worldly, life-affirming social order. Cf. *Al-Fārūqī*, 'Is the Muslim definable in terms of his economic pursuits?', in *Islamic Perspectives*, *op. cit.*, pp. 183–93. The author, however, fails to mention that despite all its 'worldism', Islam is a *moral* doctrine and there are occasions when a Muslim must sacrifice his life – the ultimate gift of God – for the affirmation of truth. This is indeed the supreme testimony, martyrdom (*shahāda*), a Muslim can conceive of and the most cogent answer to those who would hold the supremacy of *matter* over the *spirit*.

86 Essentially, all the Christian differences from the other two 'Semitic' religions stem from the ramification of the radically original Christian doctrines of the Holy Trinity and the Incarnation of God. Of course, the acceptance of the Fall is essential to Christian dogma as it supplies the *rationale* for the mysterious actions of God in redeeming mankind from its consequences.

87 St Augustine, for instance, believed nature to be 'unredeemed' and many modern Christian theologians have maintained that 'nature cannot teach man anything about God and is therefore of no theological and spiritual interest'; *Nasr*, *Man and Nature*, p. 31.

88 A.W. Watt, 'Christianity is also unique in that the historical facts upon which it insists are the miracles, betokening a state of mind for which the transformation of the physical world is of immense importance ... (and) nothing is more important for Christianity than the subservience of nature to the commands of Christ, culminating in his victory over the hardest and most certain of all natural facts – death itself', in *Nature*, *Man and Woman*, London, 1958, p. 53.

89 Yi-Fu Tuan: 'Discrepancies between Environmental Attitudes and Behaviour: Examples from Europe and China', *Canadian Geographer*, 12 (1968), pp. 176–91; reprinted in *Ecology and Religion* . . ., op. cit., p. 96.

90 A.N. Whitehead, *The Concept of Nature*, Cambridge, 1920.

91 Cf. n. 14 above.

92 Some of the consequences of the profanisation of the world may be discernible in the *materialism* of Marx, the *atheism* of Freud and *nihilism* of Nietzsche!

93 *M. Iqbal*, *op. cit.*, p. 155.

94 What is referred to as the atomism or occasionalism of *Al-Ash'arī* and the school of *Kalām* has been regarded by an eminent Muslim thinker as 'a genuine effort to develop on the basis of an Ultimate Will or Energy a theory of creation

which, with all its shortcomings, is far more true to the spirit of the Quran than the Aristotlian idea of a fixed universe': *Iqbal*, *op cit.*, p. 70. Cf. also, *Bernard*, *M.*: 'La critique de la notion de nature (*Tab'*) par le *kalām*', in *Studia Islamica*, 51 (1980), pp. 59–105.

95 *Iqbal*, *op. cit.*, p. 9.

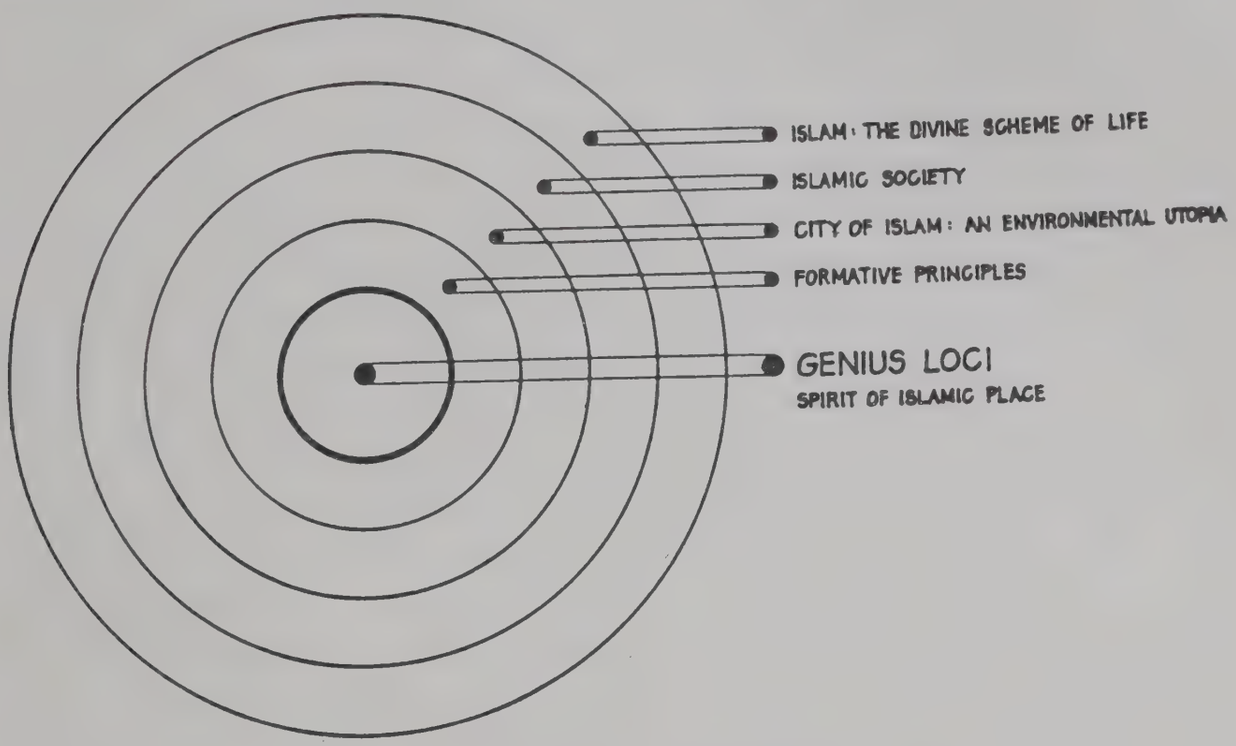
10 Habitat and values in Islam: a conceptual formulation of an Islamic city

S. GULZAR HAIDER

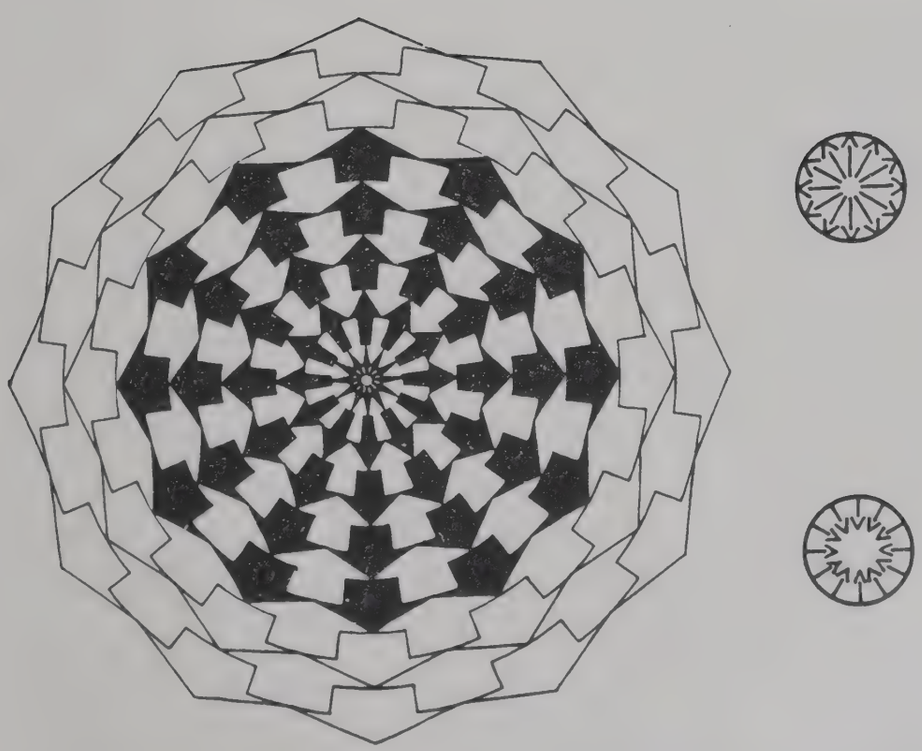
Muslims seek their spiritual energy from the Qur'ān and the example of the Prophet Mohammad, the Sunnah. Their social ideals come from the history of early Islam. But as they face their contemporary problems of government, economics, education and environment; as they decide to build their houses, roads, airports, factories and universities they seek their models from the scientifically and technologically advanced West. As Alison Ravetz points out, the dominant form of planning in the Muslim world is the Western model which is itself being discredited in the industrialised nations. With such Western models and methods come a series of attitudes that are at serious odds with Islam as a philosophy of life. Muslim psyche is thus torn between the images of the society created by the Prophet Mohammad in Medina and the reality of the Western present. They are told, and they believe, that Islam is a complete code of life but they see abundant evidence of their dependence on the West where Islam is anathema. The governments of the Muslim world are engaged in perpetual juggling acts of placating their masses who demand the fulfilment of Islamic slogans, and appeasing their Western creditors while still seeking more loans in the name of development. A dilemma indeed that must be resolved without either compromising Islam or rejecting the beneficial knowledge and skills of the West. This is the challenge that confronts Muslim societies.

One possible way out of this dilemma is to develop bold and imaginative models of alternative Islamic systems. In contemporary Muslim scholarship this type of thinking is a recent phenomenon. Sardar[1] has developed a vision of an entire Muslim civilisation as well as alternative models for science and technology policy. Siddiqui[2] is the most notable among a whole group of scholars who have developed alternative models of Islamic economics. Here, I will present a model of a future Islamic city. I start by identifying what ails the Western man whose help Muslims seek and whose example they tend to follow. Disregard for higher values and transcendental concerns are proposed as a cause of these systemic ills. I then postulate the essential attributes of an ideal Islamic society as a source of possible cures for our society. For such a society I construct a corresponding model of ideal Islamic environment as the City of Islam.

Finally, I present a set of prescriptive principles that will help in the design of Islamic environment and habitat (Fig. 1, 2).



1 From Islam to Islamic place.



2 Simultaneity among self and society. (*a*). *above-right* Exploding hierarchy from self to Ummah; self: the ultimate environmental unit; self: the seed of unifying world-view. (*b*). *below right* Imploding hierarchy from society to self; environment as shaper of self; from Islam to Muslim.

What ails the modern man?

We are suffering from an array of systematic ills. This sickness has its origins in Western thoughts and behaviour; but as contemporary Muslim societies are only a poor replica of Western ones, these ills are also predominant in the Muslim world.

The first ailment is rooted in the phenomenon that *every great idea has its abominable version very close to it* – and we have lost the acuity to differentiate. Our lives have become ridden with complexity and sophistry to the extent that the distinctions between right and wrong have become thin and very subjective. Consider how close freedom come to licentiousness, private enterprise to manipulative exploitation, how often masses are oppressed in the name of collective welfare and tyranny is perpetuated in the name of peace and order. How often in the pursuit of development and higher standard of living people are disenfranchised from their traditional and culturally sympathetic environments and packaged in multi-storeyed dwellings. The cure uproots the disease but cripples the patient.

Secular liberalism has dulled our ability to discriminate between fine aspects of good and evil, beneficial and harmful – we have become a world where right is so self-reverential that two persons with totally opposing and mutually exclusive positions can be simultaneously right in the eyes of the third.

The second ailment is the *breakdown of comprehensivity and unity*. We the scientific culture, partition a whole into its finer and finer parts. In our analytical thrust we rarely look back and forget where we started from and which paths we travelled on. Slowly but surely our whole existence becomes partitioned into categories. Having continuously denied ourselves the necessity to pause, remember and reflect on our journey, we are, individually and collectively, lost among a maze of categories and departments.

It is admirable to study nature by taking it apart and to develop classification and structures, but it is sad indeed to then bureaucratise nature into department. It is understandable that a large city will classify its housing types for logistic studies but it is frustrating when those types get frozen into bureaucratic domains like the Directorate of Squatter Settlements and Department of Commercial Housing and the two never talk to each other. The worst manifestation of this ailment is when it spreads even to institutions of learning. Fuller in his inimitable way has said 'In formulating the quadrillions of bubbles per second in the waters of Niagara Falls, nature has no time in which to refer her structural formulation decisions to bureaucratic conventions of department heads of academic categorical states'.[3]

The third ailment is man's *denial of the divine source of ethics*. Secular democracy, secular liberalism, secular utilitarianism, secular humanism

and numerous other secularisms are the operational systems of man today. One may, without any hesitation, shame or fear of ridicule declare oneself to be a logical positivist or a dialectical materialist. On the contrary one might have to be apologetic about one's religiosity in order to avoid labels of unenlightenedness, medievalism, dogmatism or even the dreaded fundamentalism.

By denying the existence of a divine schema within which humanity may find its fulfilment, modern man has left himself open to the slowly expending greyness that is manifest as emotional emptiness, depression and loss of purpose. The phenomenal success, in the West, of various imported religious and mystical cults testify to this thirst that is otherwise pacified by material possessions and sensual pursuits.

The fourth ailment is based on the *man-centred selfish view of* nature. We may call this ecological chauvinism. The techno-scientific culture takes pride in the conquest, exploitation and ultimate power over nature. It is this heady ethic of man being the owner and ruler of the physical realm that ultimately leads to moral and ecological numbness towards not only the destruction of nature but even the slow environmental poisoning of his fellow man. We lure our best talent to the destruction industry and convince ourselves that it is for peace, civilization and maintenance of our life style. There is preoccupation with life style at the expense of concern for life.

And finally, being an architect, I notice the ailment that our *aesthetic is devoid of meaning*. In our keenness to please the individual client, or in seeking approval from the multitudes in the marketplace, we have abandoned the search for beauty. We have sacrificed beauty at the altar of utility and short-term monetary economy. Much of our architecture is mere accommodation formed by the economic and programmatic imperatives. Occasionally it is gift-wrapped in the latest fashion facades and sold like the emperor's new clothes with a great deal of verbal sophistry. Most of the recent architecture of the Muslim world may be summed up as instant Islamic that promises a storybook cultural identity through an eclectic pastiche of historic motifs. Life, to grow and maintain itself in a healthy and progressive way, needs an environment that upholds the timeless values, is responsive to the present needs and signifies the societal ideals. Only a self-deceptive social reality will develop among make-believe stage settings.

A cause?

Now, is what we have discussed so far, the manifest destiny of mankind, unfolding as it must, beyond our understanding and control or is there a cause for this and a place for hope?

I take the position that *yes*, there *is* a cause and submit that it is the

arrogant denial of religious values in our life. Man may understand the single fragments of life which have increased phenomenally in number and complexity but to grasp the totality remains beyond the methodological equipment of human reason.[4] Only religion can bring the human self-conscious Self and the objectively manifest Nature as co-coordinates of the One Divine Creative Will. Religious man recognises himself as a well planned unit in the infinite organism of universal destiny. This union of Self with the Divine Purpose, this recognition that one is an essential element of the Divine Schema, transforms mere biological existence to a life of purpose, hope and love. Such life is creative and perpetually in action by thought, word and deed to nurture justice and resist cruelty. Such is the essential role of religion in society.

As a Muslim, I take the position that Islam is the primordial state of health or of nature in which God created man and the universe. Islam is the universal scheme with a comprehensive and unified purpose. Nature as well as man are subject to this. 'And whatever beings there are in the heavens and the earth make obeisance to God only with good-will or inspite of themselves, so do their shadows in the mornings and evenings'.[5] In the ups and downs of human history as well as physical cycles of nature there are signs of God's laws and justice for man to reflect upon and structure his values and actions. Man is endowed with the capacity for knowledge and is granted freedom of will and action. He can establish a society that is resonant with God's schema and thus be an Islamic society or he can reject God, become law unto himself, pursue selfish power, abandon justice and slowly become the ailing antithesis of Islam.

Islam starts with the basic belief that there is One God who is the First and Only Source of guidance for man. This guidance is the Qur'ān which has completed and engulfed all previous revelations. The Qur'ān is the message of God revealed to mankind through the medium of Muhammed, the ideal human. It is the single, essential and eternal source of God's intention for man. The Qur'ān is the Criterion (*Furquan*) between right and wrong, a prescriptive guidance (*Hidayat*) for those who seek with piety and a light (*Nur*) that dispels the darkness of doubt and denial (*Kufr*). The Qur'ān introduces itself as 'Verily, the Truth has come and error has vanished away; verily, error is ephemeral'. 'The Qur'ān is the tissue out of which the life of a Muslim is woven; its sentences are like threads from which the substance of his soul is knit'.[6]

Risalat (Prophethood) is the institution inseparable from Qur'ān (Revelation). The human Prophet is simultaneously the transmitter of Qur'ān and the living prototype of Qur'ānic scheme of human perfection. Without him Revelation could have been a mere abstraction and without Revelation, the Prophet a mere individual with personal opinions. It is in

this sense that the Qur'ān and Sunnah (Prophetic Example and Tradition) are mutually essential ingredients of God's guidance for man.

Ideal Islamic society: a structure

The declared purpose of Islam is to establish a comprehensive social order in the light of the Qur'ān and Sunnah. To understand the nature of this social order in a structural sense we have identified what may be termed as the coordinates of an ideal Islamic society. These coordinates are like a set of axes, like cardinal orientations that form the framework, the spatial-temporal reference within which all the journeys of life may be contemplated. Like beacons of light they identify their own location as primal sources of Islamic thought as well as illuminate the connecting paths among themselves.

Let us define and discuss these coordinates briefly:

1 *Iman* (Faith)

Faith in the One and Only God, His Divine Attributes, His Prophets, His Guidance and the Final Judgement. God, the Source and Destination of all existence. The Unseen Omnipresent: He is outside of things but not in the sense of being alien to them; and He is inside of things but not in the sense of being identical with them.[7] The Universe is a revelation of His Divine Will. He has bestowed on man the capacity of observation, memory, reflection, knowledge, will and love. He has sent guidance to mankind through revealed word and prophets as human models. A Just God, he has given man freedom of belief, thought and action and will hold him accountable for both his intentions and practices.

2 *Shariah* (Law)

Shariah is the revealed law and code of practice based on the Qur'ān and the model of the Holy Prophet. Divine in its source the ordinances of Shariah are rooted in the basic elements of human nature and thus are independent of sociological and technological factors.[8] Fiqh, the derived law is dependent on the social, material and intellectual environments of each age and polity. While Shariah is self-evident and unequivocal, Fiqh is the human understanding of Shariah[9] and subject to *ijtihad* (systematic new thinking) preferably through multiple effort of thinking minds – in an open arena of debate, resulting eventually in an overall consensus[10]. Shariah as a coordinate in Islamic society integrates all human action and binds the Muslims into a single community: the *Ummah*.[11]

3 *Khilafat*

The trusteeship, the vicegerency of God given by Him to man. With this comes the unique privilege that distinguishes man as Ashrof-ul-

Makhlooqat (best of creation). As with any distinction so with this comes the corresponding awesome challenge 'to man's ethical nature which must be proven through successful acquittal in the tests undertaken in the crucible of this wordly environment'.[12] The *raison d'être* of man must be 'to realize this higher destiny, this *Khilafat* (trusteeship), by his actual interference in the flow of nature and history, his diversion of that flow away from value-violation, towards value-realization'.[13]

4 *Khilqat* (Nature)

This is all of God's creations that are subservient to their respective immutable laws and do not, in contrast with man, have any conscious will and choice. This creation has three purposes: firstly as portents and signs (Ayat) for man to reflect upon and to enhance his faith (*Iman*), secondly as a book of knowledge to be eternally deciphered and thirdly as a benevolent gift whose value is in its utilisation towards the enhancement of the art of life within the coordinates of Islamic ideal. While various schools of philosophy in Islam had different views of nature, it is quite evident that they agree on the 'unicity of nature and the inter-relatedness of all things, and finally the absolute dependence of nature and the natural order upon the Divine Will'.[14]

5 *Mushaqqat* (Hard work)

Man is created for hardship and perpetual purposeful action. Idleness is the death of his selfhood. The Qur'an says that 'Nothing is due to man except what he strives for'.[15] This dimension of Islamic framework leads to the ethic of self-sufficiency and self-respect. Individuals as well as nations are to depend on no one but God and their own struggle. Artificial dependency is crippling not only for the body but for the entire personality.

6 *Ummah*

Ummah is the expression of Islamic Unity on a social plane. Muslims who uphold the Shariah, based on the Qur'ān and Risalat, all over the world, regardless of race, colour, language and temporal station are part of one *Ummah*. It is to be like one body, each part, however small, in a cooperative and supportive role to the purpose of the total. 'Only the complete Ummah comprises that circle which is Islam and no segment of the Muslim community has a right to claim to be the Ummah any more than a segment of a circle could claim circularity.'[16]

Muslim *Ummah* as a system is characterised by a single goal of existence, which is the Islamic social justice, by internally regenerative process of persuasion and perseverance against all odds and a commitment to collective benefit over individual benefit.

7 *Infaq, Zakat, Sadaqah*
This means spending in the way of God from all that has been bestowed upon man. Qur'ān ordains spending, giving, sharing and thus establishes a very strong basis for personal and social altruism. 'You cannot attain righteousness unless you spend out of what you love'.[17] The spirit of Zakat is to be sensitive to others' needs and to share from that which one has and others might not. This caring and giving can be in monetary, physical, emotional, educational and special form. Charity that has ongoing social benefit (Sadaqa-e-Jariya) is much better than sporadic charity.

The Qur'ān condemns hoarding and niggardliness and abhors its reverse evil of conspicuous waste in the pursuit of wordly grandeur and praises those who hold a just balance. It is through this concept that Islam cuts at the very roots of selfishness and greed that invariably lead to the blind pursuit of exploitative power ultimately leading to injustice.

8 *Adal* (Justice)
To uphold the Divine Purpose of Islam in the affairs of men and nature is to be just and to impede this Purpose is to commit injustice and transgression (*Zulm*, *Fitna*, *Fassad*). This Divine Purpose is the process of individual, societal and environmental progress to perfection and that ideal harmony we call Islam. Common societal manifestations of this injustice are the exploitative inequalities, suppression of freedom and thought, selfish accumulation of wealth and power and ecological rampage as exploitation of nature without concern for consequences.

9 *Jihad* (Directed struggle)
Islam requires unity of idea and action and frowns upon either idle thought or unthoughtful action. Every individual is responsible for happenings around him and to strive for the establishment of right and the abolition of wrong at every time and in every direction. Moral knowledge automatically forces moral responsibility and corresponding activism on man. A mere Platonic descernment between right and wrong without the urge to promote right and to destroy wrong is an immorality in itself.[18]

Jihad implies a struggle directed towards the establishment of a framework for facilitating the Divine Purpose of Islam. In this sense Muslims are expected to constitute a very active, dynamic, goal-oriented society that is willing to sacrifice even life if there ever is a final choice between right and wrong according to the Qur'ān.

10 *Ibadah* (Subservience) and *Taqwa* (Piety)
Ibadah is the purpose of whole life in all its details from formal worship to daily transactions. Even thought and intentions are to be in accord with

God's will. Man is to keep Him in constant remembrance and celebrate His praise as He is the Ultimate Sustainer of All Existence. *Taqwa* is to seek the righteous course and to guard against the deviations in the light of Qur'ān the Criterion (*Al-Furqan*). To be *muttaqee* is to be continuously mindful of and consciously seek Divine Beneficience (*Raza-i-Ilahi*). *Taqwa* as a coordinate of Islamic life implies caution and watchfulness in individual and societal affairs and to guard against those actions whose consequences impede the Divine Purpose. It is this concept of abject but conscious subservience (*abadiyyat*) of man towards the Boundless Master (*Malik-ul-Mulk*) that underscores the operational schema of Islam.

11 *Ilm* (knowledge), *Fikr* (Thought)

The purpose of knowledge and thought in Islam is incessant progress towards deeper understanding of the Creation and a firmer belief in its Divine Purpose. Compared with about 250 legislative verses in the Qur'ān there are about 750 verses that exhort the believers to observe, to reflect and make the best use of *Aql* (pure reason) that God has bestowed on man. 'Those truly fear God among His servants who have knowledge',[19] and then 'God will exalt those who believe among you, and those who have knowledge, to high ranks'.[20] From the Qur'ān to the Holy Prophet, to his companions and among Muslim scholars of all ages we find knowledge, its nature, its value, its sources and its methodologies to be a most passionately discussed subject. Sardar, in one of his papers, gives a wide-sweeping survey of historic and current issues of Islamic epistemology.[21] He points out the inseparability of knowledge from a value framework and a worldview. Referring to Al-Ghazalli, the celebrated Muslim philosopher, Sardar says, 'knowledge is not neutral and can indeed be infused with a nature and content that masquerades as knowledge ... What is formulated and disseminated is knowledge infused with the character and personality of that civilization ... so subtly fused together with the real so that others take it unaware in toto to be the real knowledge per se.' The most valuable aspect of Sardar's work is that he plants a seed for the contemporary models of knowledge and science within the context of Islamic values. Pursuit of knowledge in Islam is simultaneously pragmatic and aesthetic: pragmatic in the sense of facilitating life and aesthetic in the sense that it sets one on an ascending spiral converging at the ecstatic state of intuitive recognition of Divine beauty manifest in the creation. Antithetic to this concept is the pursuit of knowledge with the purpose of achieving control and domination over nature and aiming at establishing man as the self-sufficient ruler of the world. For this viewpoint God is either non-existent or unnecessary.

12 *Jamal* (Beauty)

In Islamic psyche an aesthetic experience is equated with recognition of truth and perfection be it in a person, an idea or an object. The Qur'ān states that God's creation is flawless, He has created nothing without purpose and His provisions for man are *taiyib* (good, pure, clean, pleasing). The Prophet in glorifying God tells us that He is beautiful and loves beauty.[22] Al-Ghazali states that 'Spiritual beauty perceived through reason is nobler than the beauty of images perceived through sight'.[23] In the experience of beauty senses are important but not sufficient. Beauty as ethic of perfection is fundamental. Nasr says beauty is an intrinsic dimension of truth and its manifestation and it is therefore a necessary component of every legitimate artistic creation. Islam never separates beauty from utility or art from making.[24]

It is important to point out that the separate identification, one by one, of the above coordinates was with the temporary object of an analytical discussion of the structure of an ideal Islamic society. These coordinates all focus, simultaneously and without any mutual antagonism to the irreducible concept of *Tawheed* (Unity). This is the kernel of Islamic worldview. It is important to point out that *Tawheed* does not demand uniformity but requires unity through interrelatedness under the Divine Purpose. It is an injustice to Islam to pursue any one coordinate to the deliberate exclusion of the others.

Shirk, the partitioning of the divinity of God, is the antithesis of *Tawheed*. *Shirk* leads to a world view 'that regards the universe as a discordant assemblage full of disunity, contradition and heterogeneity, processing a variety of independent and clashing poles, conflicting tendencies, variegated and unconnected desires, reckonings, customs, purposes and wills. *Tawheed* sees world as an empire, *Shirk* as a feudal system'.[25]

City: the society manifest

Environment can be seen as two concentric spheres with interactive mutual boundry. The outer sphere represents natural environment. It affects life in all respects but is not directly of man's making. This natural environment is essential to healthy human existence and requires respectful treatment.

The inner sphere encompasses the man-made environment. It is the result of man's direct manipulation and transformation of his environment. Human settlements are the most succinct example. From agricultural hamlets to the complex megalopoli there is one common theme, that every human settlement is a concretised expression of a society's schema of life. City, in its most generic sense, is a civilization's way to define a world within the larger world.

As history, a city, its institutions, its structure and its architecture are impressively honest in laying bare the value structure of its builders and its inhabitants. As a physical entity it is a built expression of the balance between the 'inward' forces of a society that forms and maintains the life patterns of its members and the 'outward' creative forces of the patrons, designers and builders who interpret and even anticipate the aspirations of this society. While individual buildings and building types can provide significant insights it is the human settlements – towns and cities – that represent the complex mosaic of a society's aspirations.

Thus, to understand the Islamic position on environment and habitat, it is natural to turn to the history of Muslim cities. There is an apparent abundance of historical, archaeological and interpretive literature on the cities of the Arab-Muslim world. Von Grunebaum,[26] Grabar,[27] Lapidus,[28] Hourani,[29] Abu-Lughod,[30] Adil-Ismail,[31] Stern,[32] Goitein[33] and many others have pointed out, though not always consistently, the correspondence between religious institutions, socio-ethnic structures, systems of commerce, local government and urban form of the Muslim city. From a study of this literature one does not emerge with a coherent notion of an archetypal city. However, there are a few observations that can be made:

1 Authors like Nasr,[34] Berque,[35] Ardalan[36] have seen the Muslim city as a direct manifestation of the concept of *Tawheed* (Unity) in Islam. Norberg-Schulz[37] has suggested the images of 'desert' and 'sky' as the cosmic macro-world and the source of Islamic genius Loci (spirit of place). Within this totality the Muslim mind seeks and constructs his individual locality, the 'oasis'. Al-Hathloul[38] and Ali Safak[39] have shown a very intimate relationship between Shariah and the Islamic urban form and structure.
2 The Muslim city as a system has some perennial elements such as *masjid*, *madressah*, *suq*, *rabat*, *hammam*, palace, residential labyrinth, garden, walls and gateways. Their mutual structural relationships represent a certain constancy.
3 The morphology of some Muslim cities show the memory of basic structure of the pre-Islamic towns that were taken over and transformed.[40]
4 Unlike the Greek or Roman civilization Muslims did not develop an archetypal city except 'insofar as the religious and institutional centers would become normative by presenting the Muslims with articulated models of a way of life'.[41]
5 Some Muslims cities were commissioned as grand and auspicious centres of power (Fathehpur Sikri, Samarra) but being unnatural for various reasons[42] did not succeed. Others declined quite symptomati-

cally with the decline of Islam as a motive force in the affairs of the Muslim world.

City of Islam: an environmental utopia

In this essay, so far, we have attempted to present Islam as an ideology, as a path of life that can cure mankind's systemic ills; we have put forward essential attributes of an ideal Islamic society and have proposed study of human settlements as a methodology for the understanding of a society, especially its position on environment. Before we proceed to establish the Islamic position on environment and habitat the following has to be stated:

1 History as a source is important but not sufficient. It is dangerous to be a Homeric man who always looks at the past that is frozen remembrance. It is equally risky to look only to the future because it is uncertain and holds no experience. In the manner of the legendary two-headed eagle we have to look simultaneously at the past for wisdom and at the future with idealistic vision.
2 Idealism is essential for creative existence. Only those who seek perfection have any chance of progressing towards it. However, no journey towards an ideal destination is without sound beginnings and a desire for well-charted paths.
Idealistic visions that are grudgingly compromised with the constraints of current reality always have a higher quality than the solutions that are arrived at by mere pragmatic and immediate concerns.
3 Utopian constructs postulated by man are a revolt against unpleasant reality. It is comforting to imagine a utopia free of all ills and performing with perfect harmony. There have been numerous utopias which were never meant to be built but there is little doubt that they provided bases for critical evaluation of those works that were built. In this sense utopia is a valuable instrument of critical thought.[43]

It is instructive to note that while the Qur'ān presents a framework for life on this earth that is very real and attainable it often uses the Paradisial images and beatific analogy to set utopian targets so that this worldly life is always striving to reach ever-higher levels of perfection within the Divine Schema.

It is in the light of the above statements that we have taken a two-tiered approach to defining the Islamic position on environment and habitat. On the upper tier we have tried to postulate via its attributes an ideal Islamic environment as a City of Islam: a concrete expression of the belief and action structure of our ideal Islamic society. On the lower tier we have proposed a set of design principles that can be used by architects and

planners to chalk out their respective journeys towards attaining proximity to the ideals of Islamic environment.

At the foundation of our model for an Islamic society we suggested three fundamental concepts: belief in God as unpartitionable Unity, belief in Divine Guidance as Qur'ān, and acceptance of the Prophethood of Muhammed as the Messenger of God and human exemplification of the Qur'ān. In proposing a corresponding environmental analogue, the Islamic City, we can start with three fundamental images:

1 Dar-al-Iman: City as a community of believers (*Moumeneen*) whose individual and collective efforts are to live within the framework of Islamic belief.
2 Dar-al-Qur'ān: City as a medium of Qur'ānic guidance (*Hidayat*): The Qur'an as Knowledge (*Ilm*) that structures the reality of existence, the Qur'an as criterion (*Furqan*) that discriminates between right and and the Qur'ān as light (*Noor*) that brightens the Straight Path of God.
3 Dar-el-Sunnah: City as a crucible for realising the Prophetic model at the individual (*Uswah-e-Rasool*) as well as the collective level (Medinese Society).

Building on these basic images we will now list, with brief elaboration, the attributes[44] (Sifaat) of this ideal Islamic environment as the City of Islam (Dar-el-Islam).

City of divine trusteeship

Islamic City is a microcosm created by man in the fashion of God's creation of the world. There is individual freedom contained by responsibility to the collective (*Ummah*), there is trust with answerability to God. The Islamic city is a representative outpost of God's scheme that is man watching his affairs under the title of trusteeship (*Khilafat*) of God. In Islamic City the criterion for right and wrong is not from man but from God and there is little room for the arrogance of secular humanism.

City of law

Islamic environment is to provide the support structure for Shariah and in turn be formed by it. There is to be a delicate equilibrium between the rights of the collective against those of the individual such that one is not antagonistic to the other. Such an environment will provide security and protection not so much by imposed controls as by social responsibility and mutual accountability.

City of justice

An environment that both by its morphology and its institutions establishes egalitarianism without imposing grey uniformity. An environment

that breaks down class structures without destroying natural hierarchies sanctioned by ethical tradition. Such an environment encourages selfhood without selfishness and pride without conceit. No wrongs are done, no rights are curbed and no lies are told – in social, intellectual as well as physical realms. There is no tyranny in either thought or deed.

City of causality and accountability

An environment that instigates and nurtures the attitude that every act has consequences which must always be partitioned as beneficial or harmful. In Islamic framework it is rare to find a benign act. The individual as well as the collective are to concern themselves continuously with whether what they do is beneficial in the short term and harmful in the long term or beneficial to an individual but harmful to society or nature. When citizens think of causes and effects, acts and consequences, benefits and harms it becomes an environment of responsibility and accountability to self and to God.

City of purpose

The city is to be like a human body – millions of tiny parts bound together in one cooperative purpose. There is a civic sense of unity in purpose but diversity in processes. Opposing trends in various processes, for example housing and commerce, are to seek a balance and not to pursue selfish domination of one over the others. Cancer cells are fearful examples of selfishness: they grow with abject ruthlessness until they destroy their host body and thus commit suicide.[45] Islamic environment is to take all measures to prevent such environmental, economic, social or architectural cancers. Such environment is internally cooperative and synergetic and thus its reality goes beyond the sum of its physical parts.

City of care

Islamic environment which is created by collective vision and individual effort is to always serve as a place of rest, refuge, care and protection for those who are less fortunate or handicapped. It is a collective duty of the able to care for the disabled, for the knowledgeable to guide the ignorant and for the strong to protect the weak. Public welfare and social institutions, though being a natural part of the Islamic milieu, are to be such that they do not start a cult of dependence.

City of life and energy

An environment that is ascending and progressive in the sense that it is always struggling towards its ideal of being a City of God. A purposeful environment that becomes a means of implementing Islam's inwardly consolidating and outwardly expressive energy. Such an environment is

responsive to internal feedback of the citizenry, adaptive to cultural change but resistant to compromise at the level of fundamental principles.

City of ecological harmony

An environment that is in a symbiotic, mutually enhancing relationship with nature. Key values are to conserve not waste; to seek enhancement of the art of life rather than the entropic decay; to seek the ideal that every short-term consumption leads to long-term rejuvenation or creation of new resources; to change the attitude from the survival of the fittest to the survival of the most beneficial. It is an environment that puts great value on physical and mental health. But more than anything else it nurtures the attitude that every situation of apparent conflict between man and nature is an opportunity to design such that the solution is of benefit to both man and nature.

City of knowledge

It is important to recognise that environment can excite the state of wonder, it can spark novel images and constructs, it can provide clues and answers and it can intrigue one to search forever – an excellent teacher indeed. As the Prophet likened himself to the City of Knowledge (*Madina-tul-ilm*), we get the most complete image of the ideal Islamic environment as a source book, a fountainhead of man's perennial thirst for knowledge.

The Islamic environment will be a fertile ground for scientific inquiry and technological development. Unlike its secular, materialistic counterpart it will distinguish itself by its value orientation. The pursuit of knowledge in such an environment will enhance the belief in God's Divine Schema rather than weaken it. There will be little risk of setting the 'student' on a regressive path of agnosticism and atheism that eventually leads to a society of scientific absolutism whereby eventually man considers himself to be sole master of his destiny.

City of simplicity, humility and piety

An environment that values simplicity as economy of means towards generosity of ends. That stresses avoidance of arrogance and extravagance and encourages graciousness and sensitivity. An environment that creates a sense of place which, though being of this realm, is continuously indicative of responsibility towards the hereafter through highlighting our duties to God and fellow man. The built form celebrates the rituals of man's subservience to God and supports the social acts of service to the fellow man. It is an environment where a mosque, a *madrassah*, a public bath and a garden can exist in harmony and all be supported by the bazaar.

City of ingenuity and craft

Islamic city is a problem-solving environment that values skills, hard work and ingenuity. It is an environment where creativity and craft are a form of worship, a homage by the believer to the Creator of all the man's abilities. It is an environment that upholds self-reliance and discourages unnatural dependencies. There is a direct, tactile, constructive interaction with one's own surroundings be it the building of a mud house, the sewing of a garment or the care of a garden.

City of beauty

Islamic environment is the medium of beauty arranged by man and presented as an offering to the One and Only God Who wills all that is beautiful. It is beauty as the Perfection of an Idea and therefore the ultimate formative value in any human endeavour; a sense of order that inspires aesthetic response; a beauty that is hidden, elusive, transcendental - a beauty beyond our sense-bound and fashion-dependent normative tastes.

Design principles for Islamic environment

We may now turn our search to the Design Principles that amalgamate the ideals of Islamic environment as postulated above and the aspirations of architecture as we know them from all the great traditions of man. Three main formative values are proposed from which the design principles are extracted:

1 Environmental sensibility
2 Morphological integrity
3 Symbolic clarity

Each group is briefly described and illustrated with examples from architecture of the Muslim world:

Design principles based on environmental sensibility

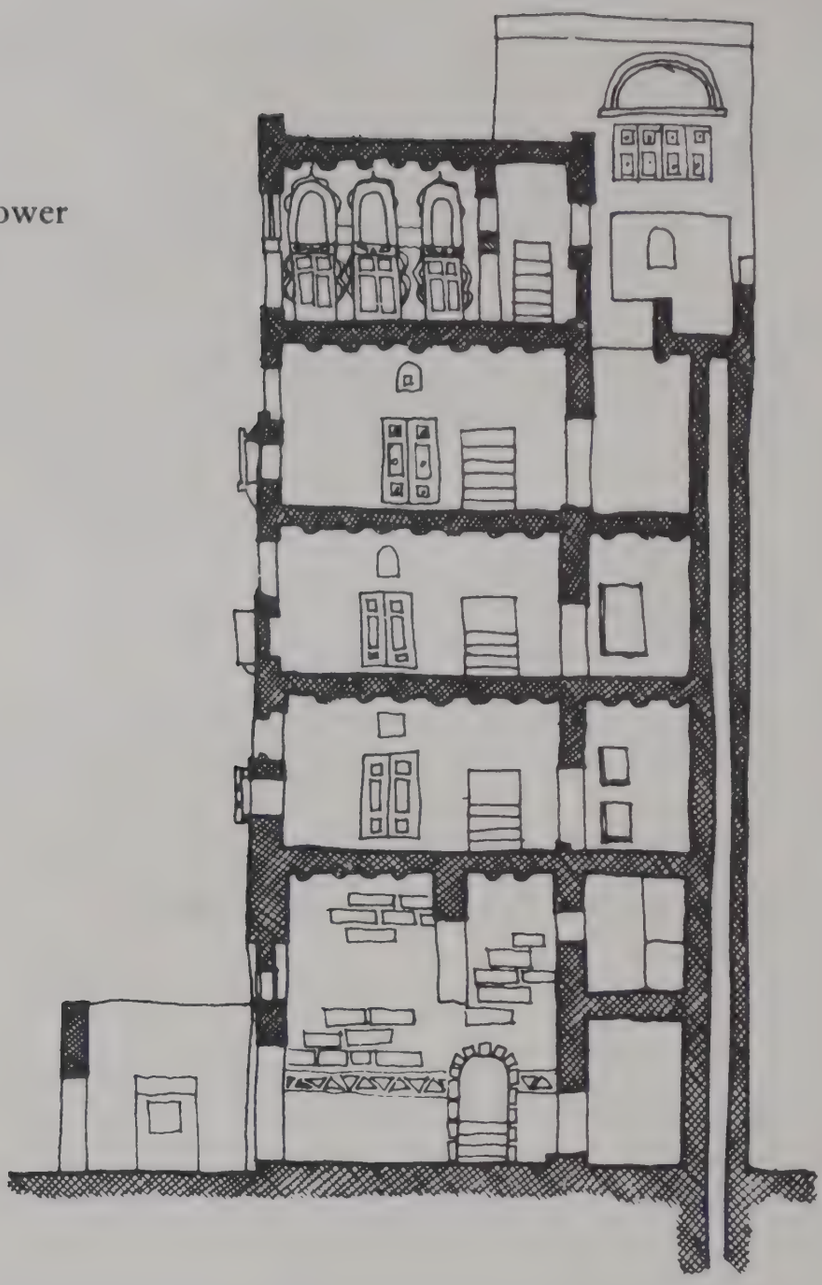
1 *Of plains, mountains and rivers*: implies respect for natural topography especially land form, bodies of water, trees, orientation and visual focii. (Figs. 3, 4)

2 *Of seasons, sun and air*: implies respect for climate as the prime reason for enclosure and the original motivation for architecture. Architecture is to respond to climate with the same manner of honesty and directness as sand dunes respond to wind or the tropical forests to rain. The aim is to extend periods of comfort without excessive technical intervention and without shutting oneself in from the natural cycles of seasons and day and night. Rights to sun and air are to be treated as sacredly as rights to life and liberty. (Figs. 5, 6)

3 Of plains, mountains and rivers: Alhamra, Granada, Spain.

4 Of plains, mountains and rivers: Rumeli Hisar, Istanbul, Turkey.

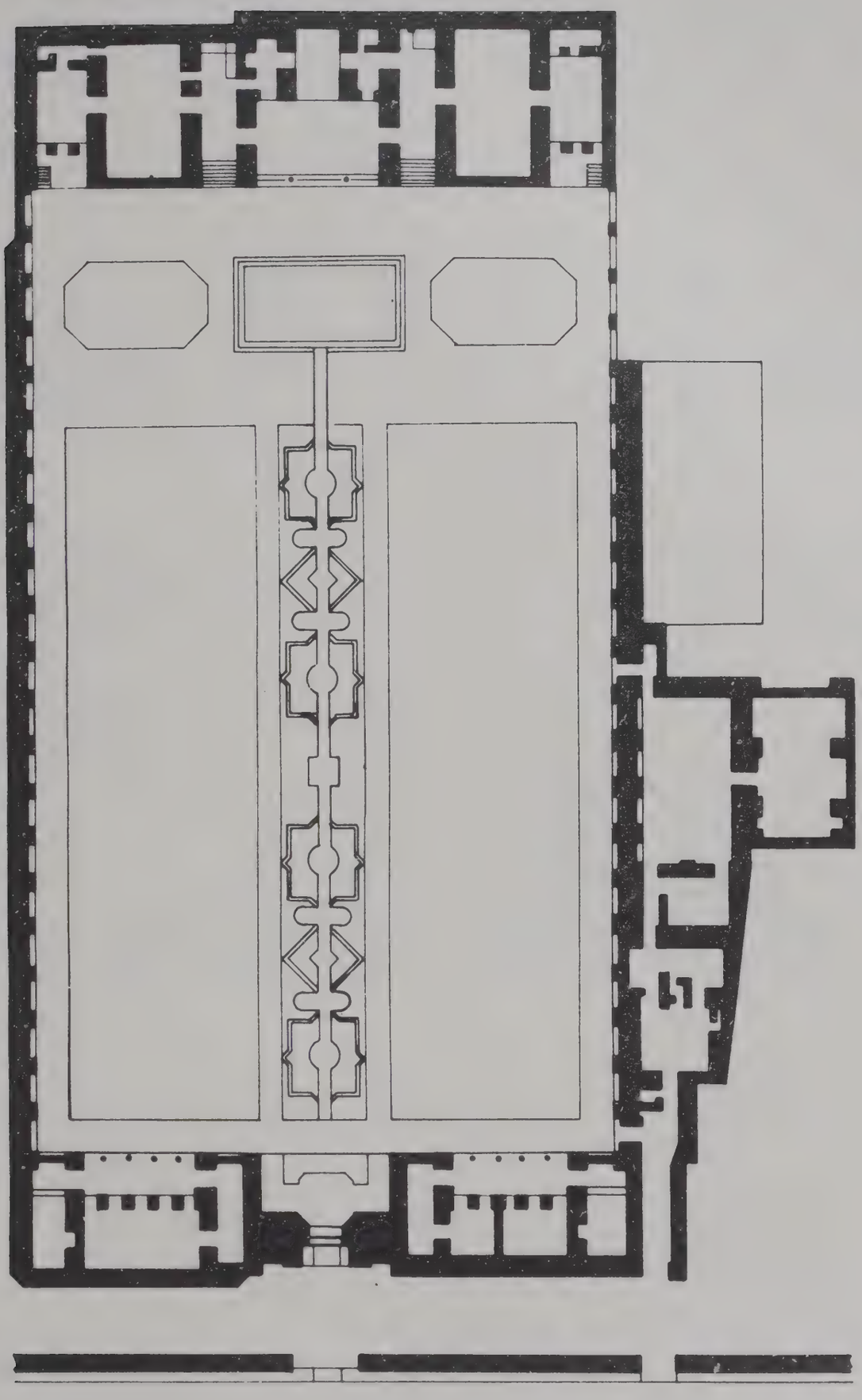
5 Of seasons, sun and air: old house, Baghdad, Iraq.



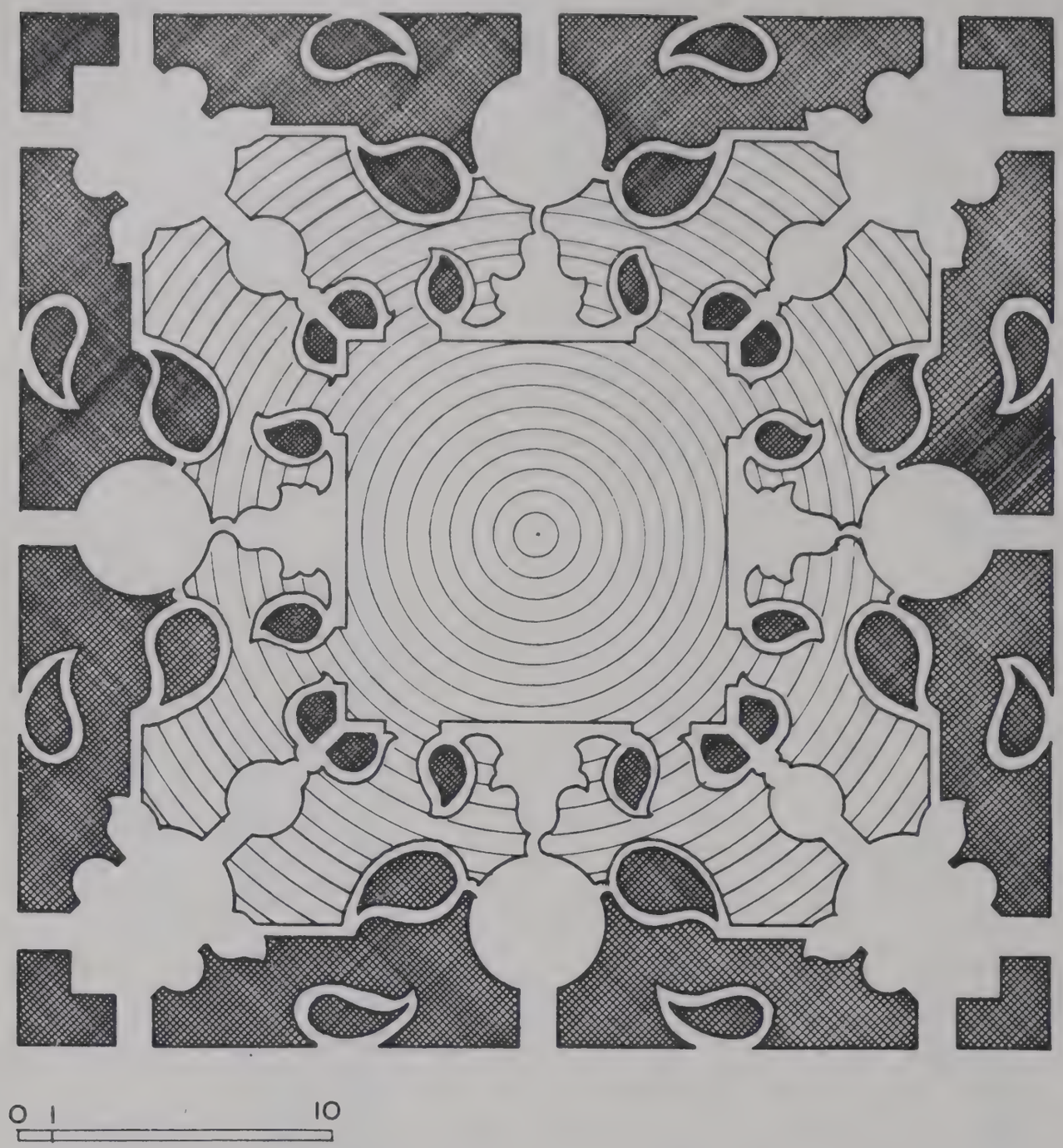
6 Of seasons, sun and air: tower house, San'a', Yemen.

3 *Of gardens, flowers and pools*: No human psyche is to be deprived of the experience of nature's symphonic landscape that provides a paradisial image and an excellent allegory of life. Reflections on the phenomenon of growth and decay are essential to the development of human mind. Ideally the architectural experience should be a balance between the organic and the inert. The landscape as garden may contain architecture and in turn be contained by architecture as courtyard, flowers and pools. (Figs. 7, 8)

4 *Of materials, tools and crafts*: Formed matter is the sensual reality of architecture. Sensitivity to the nature of materials, ingenuity of techniques, economy of effort, dedication to craft and a transcendent ideal transform inert matter into a work of art and architecture. The degree of intervention in the natural state of the material to its final state implies a technical progress but unfortunately also indicates our degree of separation and divorce from the origin of things. Technology in this sense is far from



7 Of gardens, flowers and pools: Narengestam-e-Qavam, Shiraz, Iran.

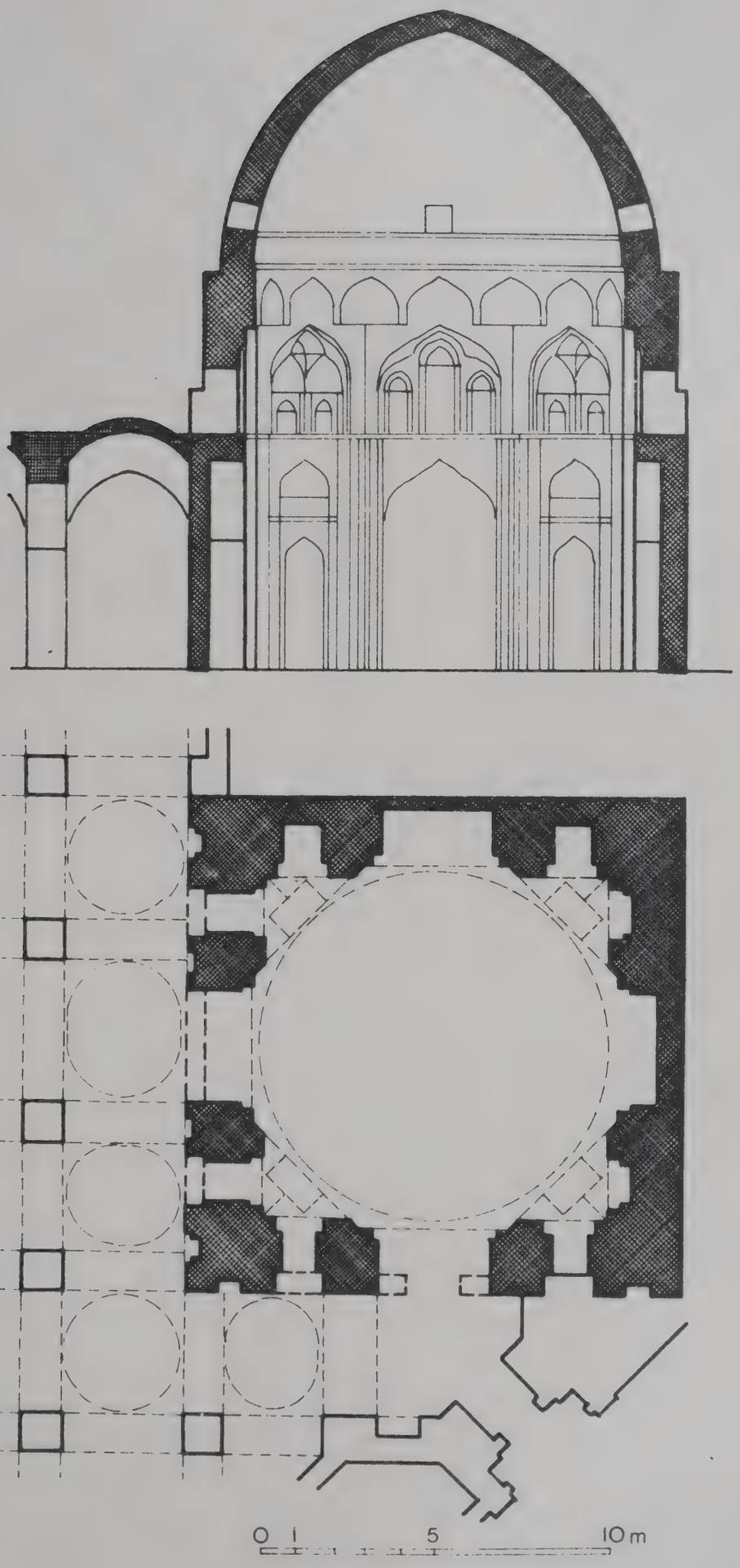


8 Of gardens, flowers and pools: pool, Jag Niwas Palace, Udaipur, India.

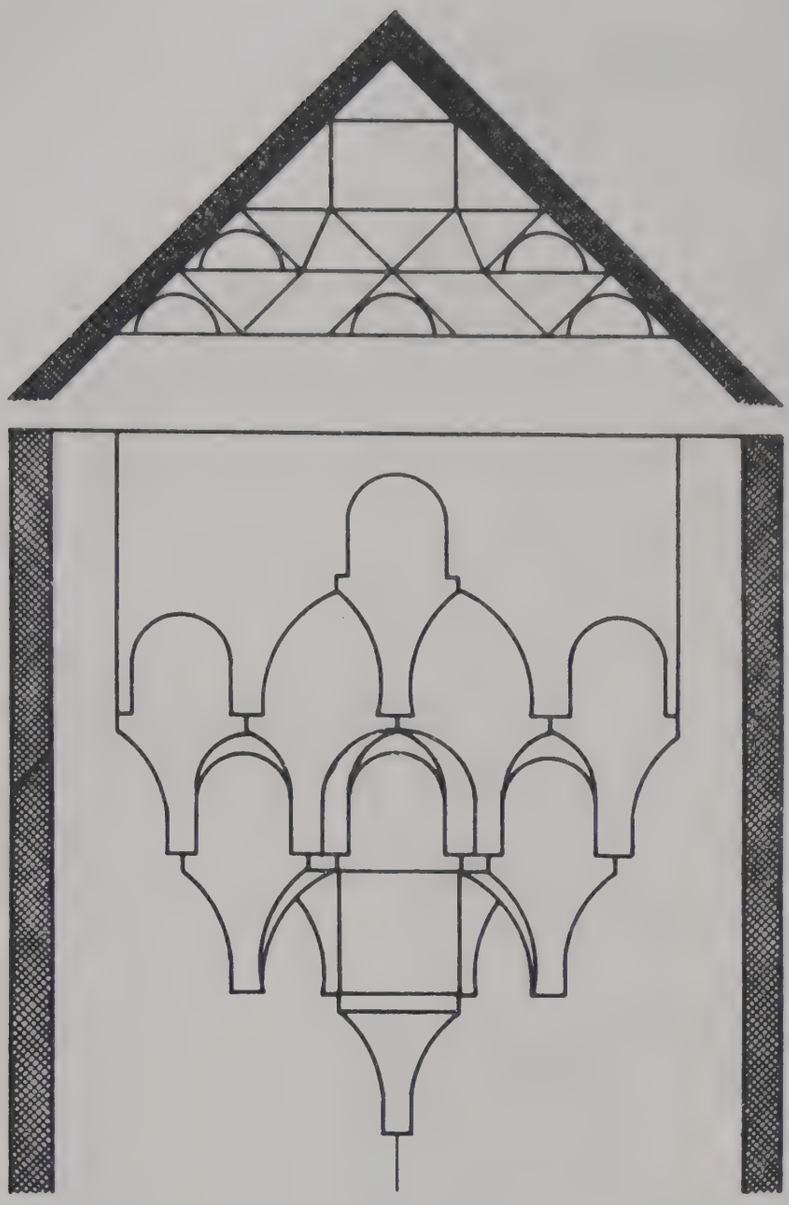
value-free and therefore requires a strict value discipline within which it is selected, developed and deployed. (Figs. 9, 10)

Design principles based on morphological integrity

1 *Of size, scale and quality*: Public intimacy in the mosque and bazaar, private security within the house wall and beyond the gateway, pedestrian vantage point in the gardens, an overall sense of calm and balance and the general avoidance of extremes indicate a heightened sensitivity to the human scale in historic Islamic architecture. In our times a special effort has to be made to return to appropriate human scale both in social systems and physical environment. It is primarily a matter of attitude on the part



9 Of materials, tools and crafts: Gunbad-e-Kharka, Masjid-e-Jami, Isfahan, Iran.

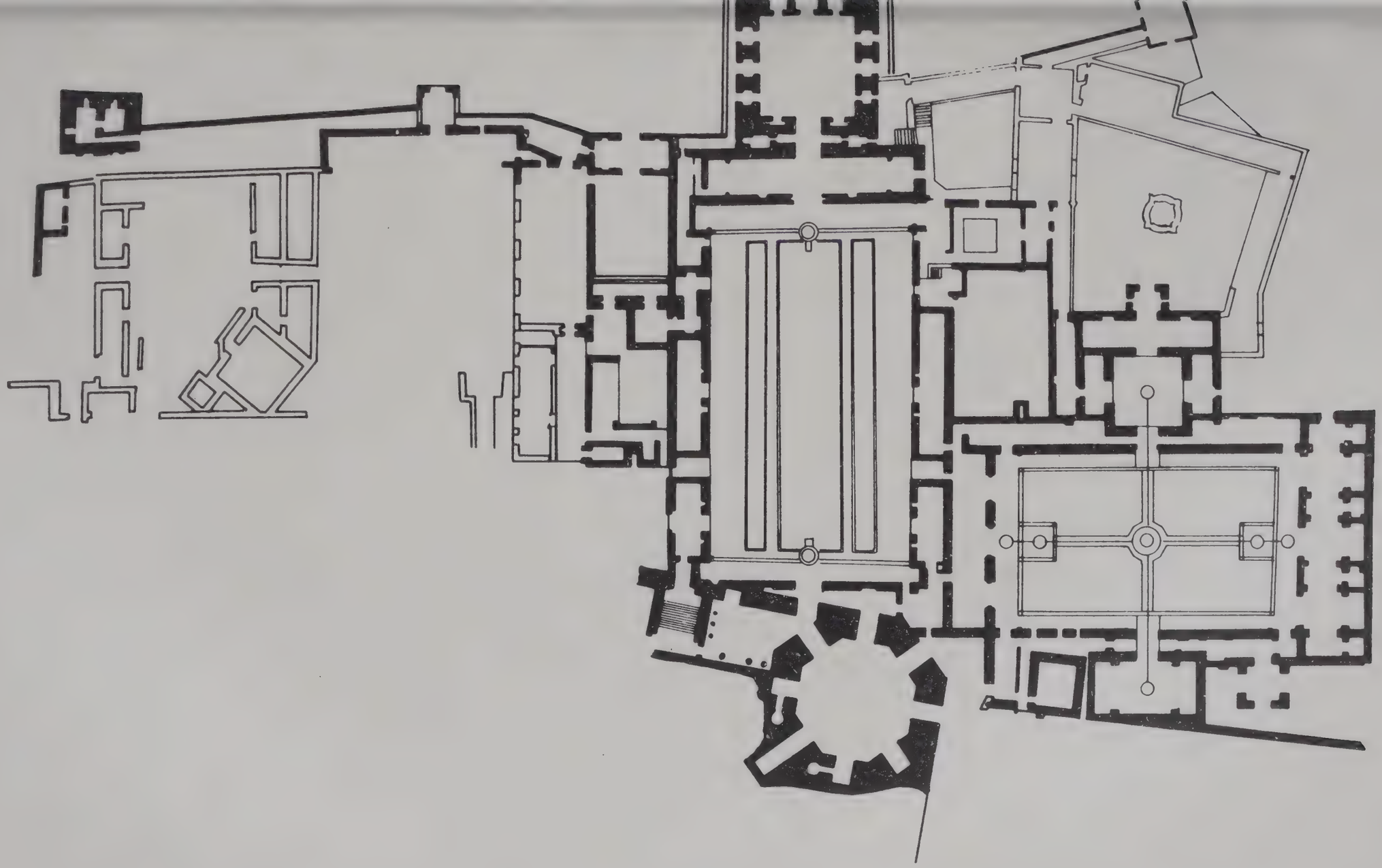


10 Of materials, tools and crafts. (*a*). *left* Muqarnas. (*b*) *above* Seljuq tile, Konya, Turkey.

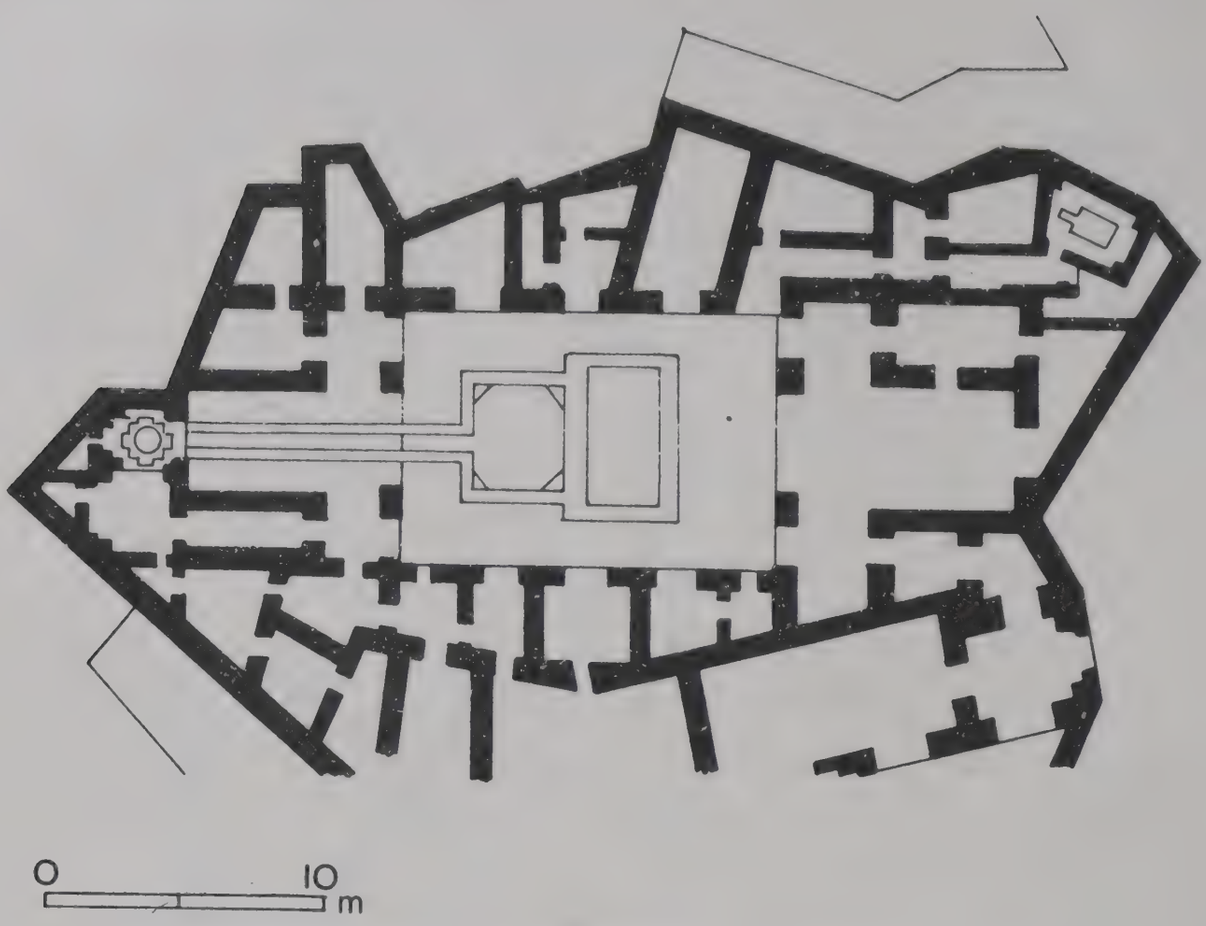
of planners, architects and much more so the clients. They have to free themselves from the sickness of superlative statistics and stop equating bigness, grandness and monumentality with quality. (Figs. 11, 12)

2 *Of space, enclosure and form*: Architectural design aims at meaningful space-making and form-giving. Orchestration of space to support a particular process or to convey a special meaning is a challenge for all designers. Space lends itself to many direct, indirect and subtle ways of definition: e.g. total containment, partial enclosure, interpenetration, layering, interplay of opacities and transparencies. In historic architecture of the Muslim world 'form follows space and space is adapted to function'.[46] Space is contained by layers of opacities of different densities, but is in itself expressive independent of the container. This concept is that of an architecture where the mind is more interested in spatial integrity and image rather than in material objects in space.[47] (Figs. 13, 14)

3 *Of beginning, paths and destinations*: Islamic environment has a labyrinthian continuity in both its purpose and form. Continuity suggests



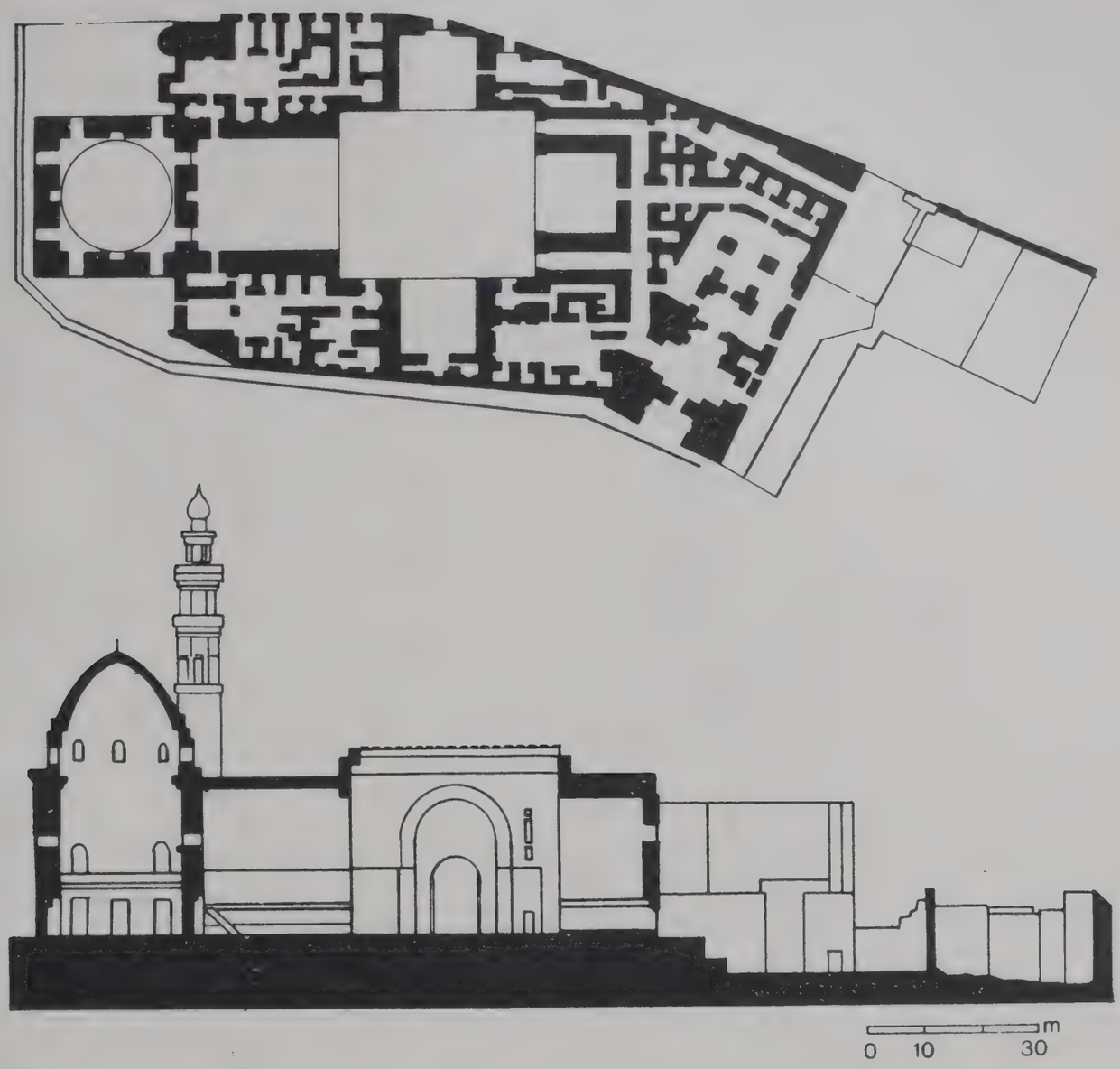
11 Of size, scale and quality: Alhamra Palace, Granada, Spain.



12 Of size, scale and quality: a Fatimid House, Old Cairo, Egypt.

deliberate transition among polarities of outside and inside, public and private, open and narrow, house and mosque. The significant nodes in this continuous labyrinth have their own internal continuities suggested for example in the mosque by the forest of columns and in the house by rooms around the courtyard. While physically bounded the Islamic environment gives an impression of infinite continuity. (Figs. 15, 16)

4 *Of orders, structures and hierarchies*: Order is essential to expression of the significant in any phenomenon. Structure is necessary condition for anything the human mind is to understand.[48] Ordering principles and devices are therefore the key to the creation of an architecture of purpose and meaning. Islamic architecture is to achieve its integratedness and ultimate sense of unity through the search for mutually sympathetic orders of function, meaning, symbol, geometry, gravity, energy, light, water, movement. Hierarchies with transitional connectivity among various levels is a well tested ordering device in Islamic environments. For example the entire Islamic city may be perceived within a hierarchichal structure of individual to collective by considering the levels of the house, street, crossings, *suq*, bazaar, bath house, *madressah*, garden and *masjid-e-jamii*. Islamic environment is characterised by parts to whole and whole to parts relationships – simultaneously differentiated and integrated. (Figs. 17, 18)

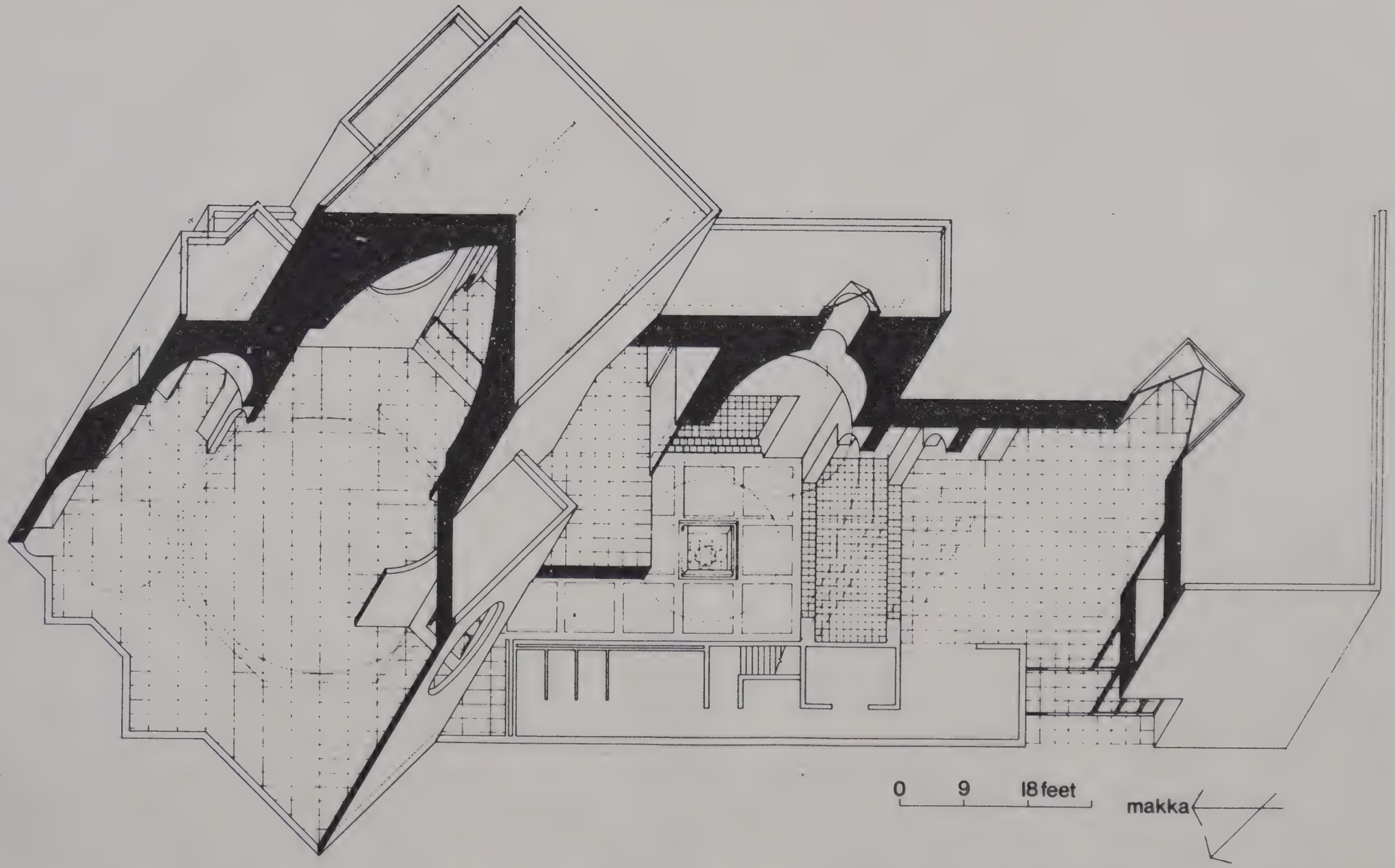


13 Of space, enclosure and form: Sultan Hasan Mosque, Cairo, Egypt.

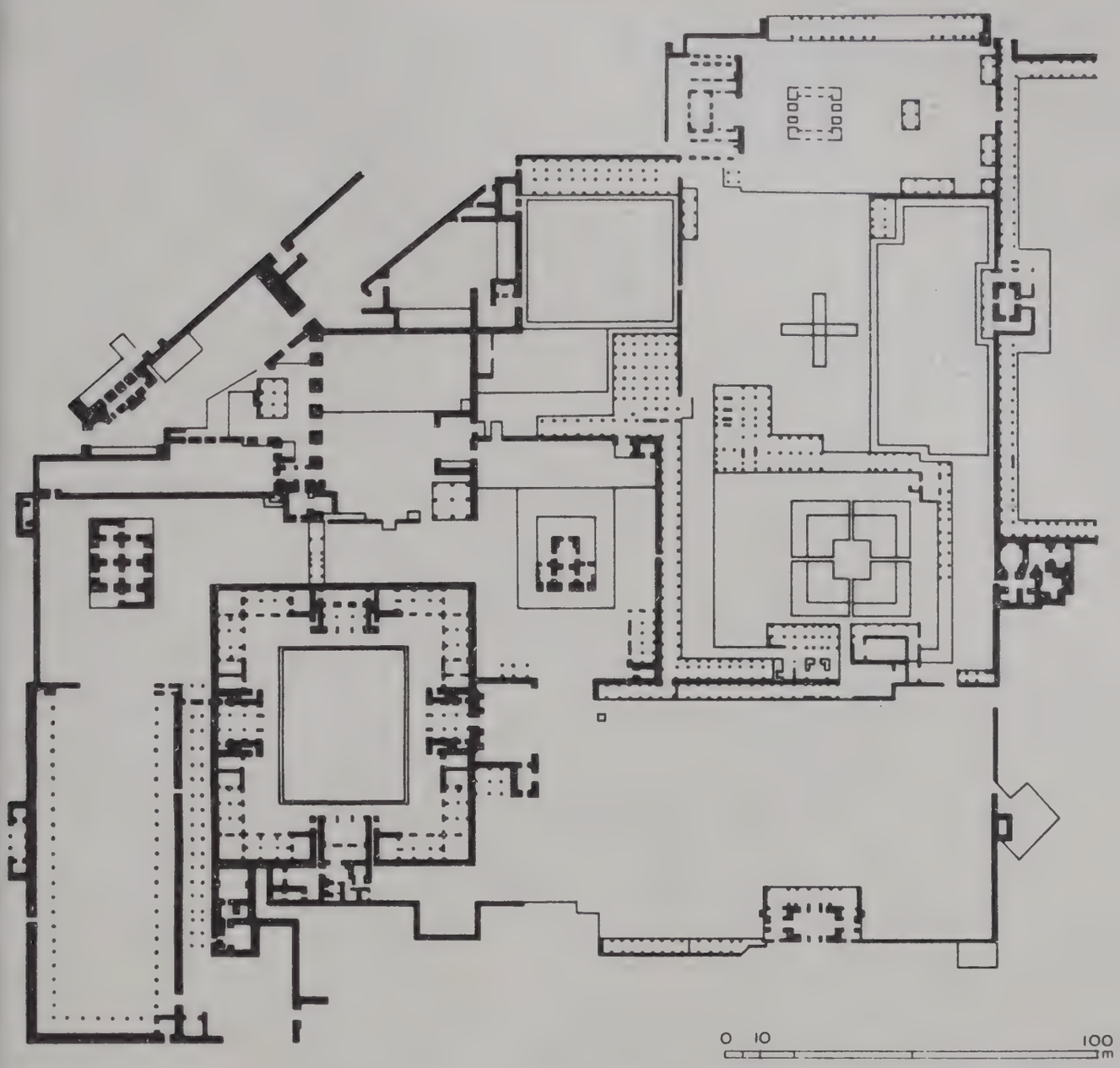
Design principles based on symbolic clarity

1 *Of tradition, culture and identity*: Tradition is normative behaviour forming the basis of cultural continuity. Identity is based in socio-cultural acceptability. Architecture of Islam is to encourage full expression of selfhood and identity without damaging the pervasive unity of *Ummah*. Special nature of the door to a house, unique character of a bazaar or pervasive materials and forms of buildings are all ways of recognising one family from the other and one quarter of the city from the other and cities in one region from those in the other. Islam as an idea transcends both culture and tradition and thus allows their full expression within the bounds of *Shariah*. It would be injustice to Islam to expect a universal, prototypical expression of its architecture. (Figs. 19, 20)

2 *Of elements, connections and meaning*: Architectural whole is made up of elements and connections among them. The history of architecture of



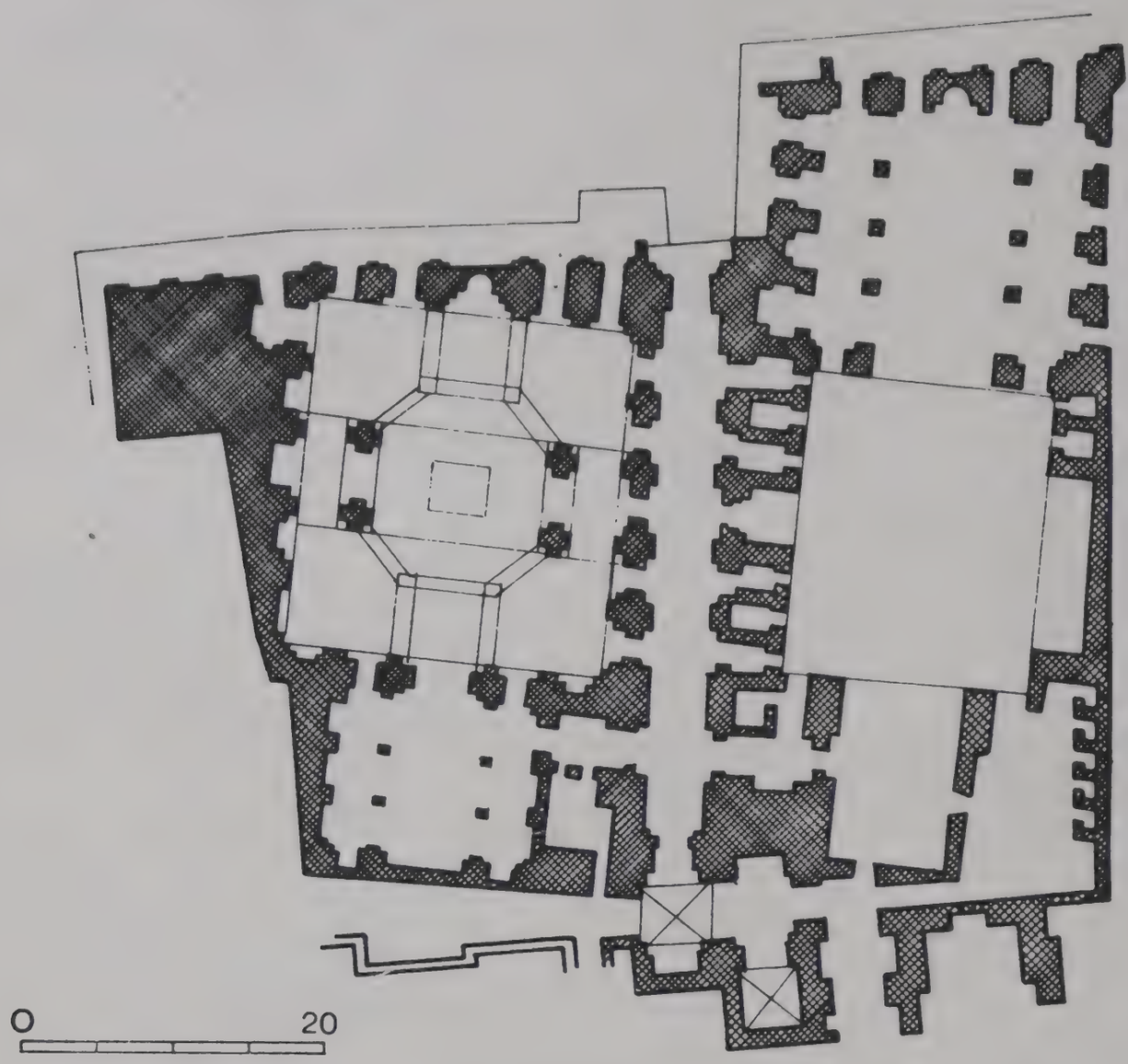
14 Of space, enclosure and form: ISNA mosque, Plainfield, USA. From presentation drawings of the Islamic Center of North America project, designed by the author with DANA Architects, Chicago, 1981.



15 Of beginnings, paths and destinations: Fatehpur Sikri, India.

the Muslim world gives us a rich mosaic of elements such as wall, gateway, arcade, courtyard, pool, fountain, minaret, dome, screen and skylight. A masterly composition of such elements resulted in a meaningful architecture of sublime quality. It is our duty today to create not only a relevant language of elements but also to explore their compositional rules with the objective of achieving an environmental syntax with socially relevant meaning. (Figs. 21, 22)

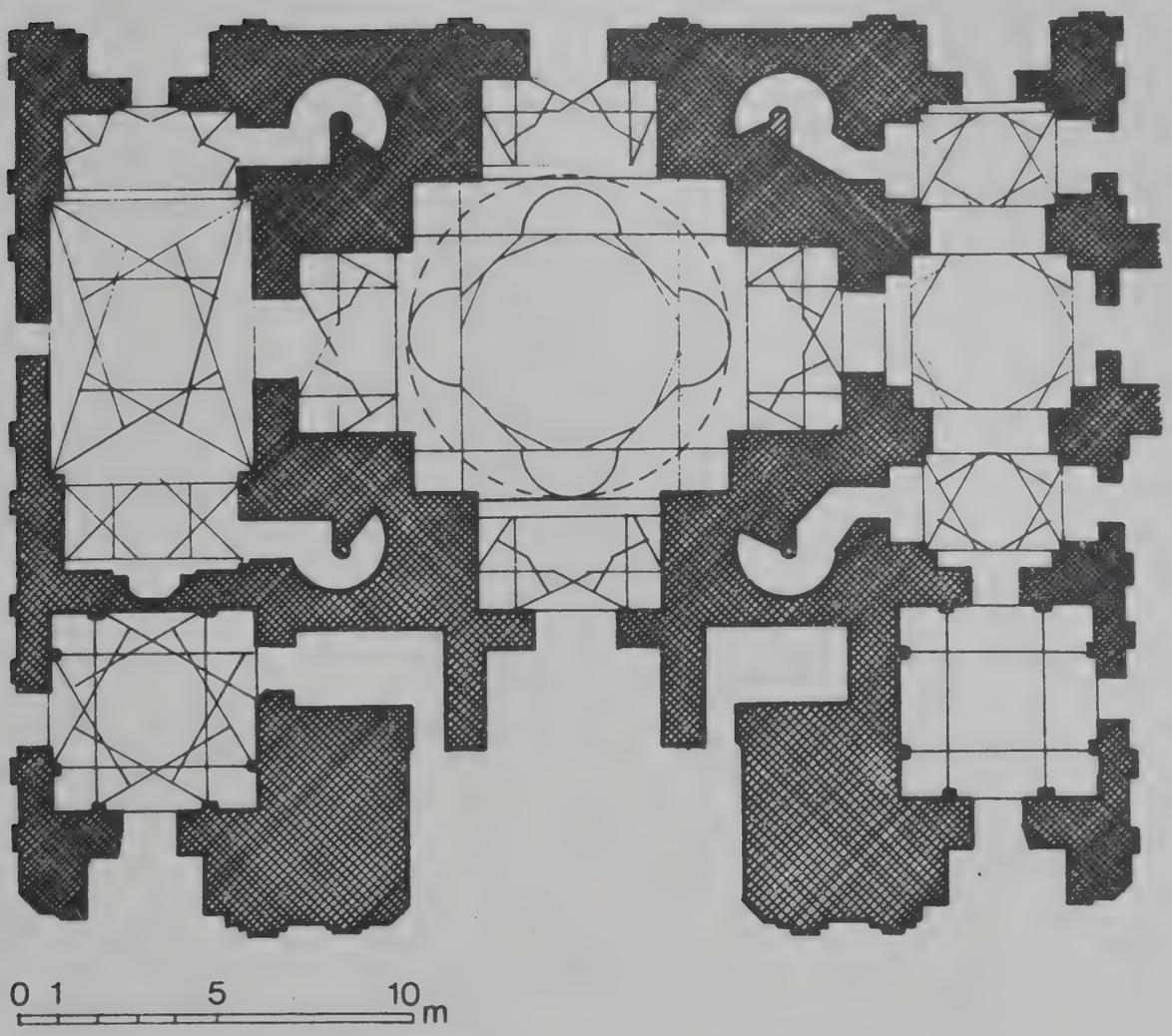
3 *Of beliefs, emotions and sensations*: Architecture has a phenomenological dimension in that it acts as a stage for the rich and complex play of life. Spiritual attitudes and emotional states can fundamentally effect the sensory reality of architecture. For a designer, therefore, it is a challenge to create architecture that provokes experiences and phenomenan that constitute an Islamic expression of life. It is only in this sense that the



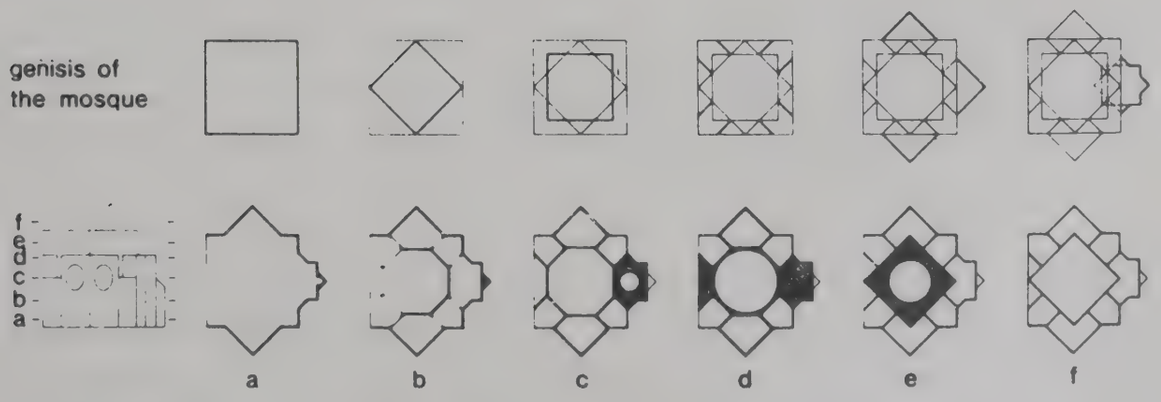
16 Of beginnings, paths and destinations: tomb and Madrassah of Sultan Qalaun, Cairo.

environment transcends its inert physical reality and acquires the eloquence of a living organism. (Figs. 23, 24)

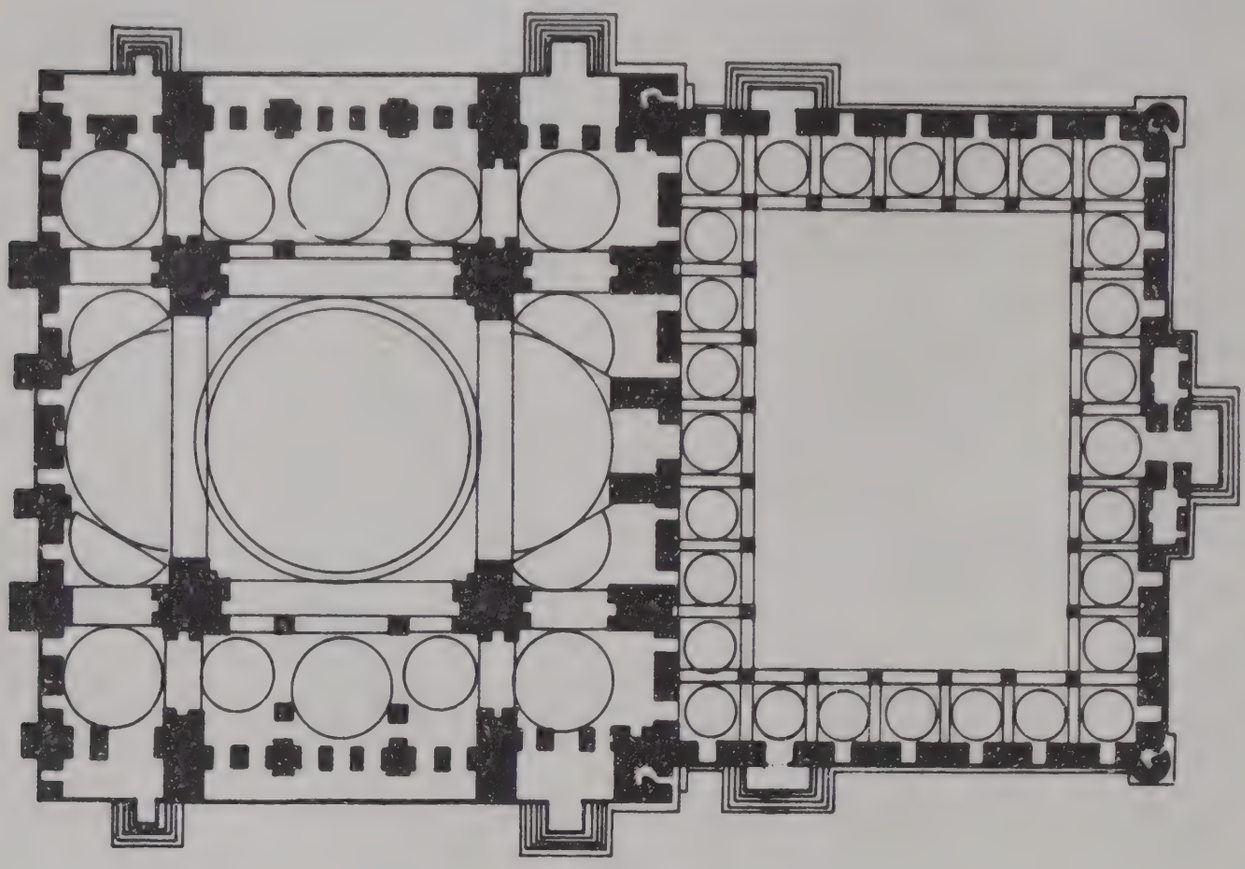
4 *Of metaphors, allegories and symbols*: Symbols evolve slowly and acquire meaning within a collective, societal frame of reference. It has been a matter of considerable debate as to the existence of universal symbols in Islamic art and architecture. This much, however, can be said, that Islamic environment, whether it emerged slowly or was designed and built as a single act, could not break away from a desire to celebrate, however subtly, the Divine Schema of Life: especially the notions of creator and created, here and hereafter, right and wrong, earth and sky, darkness and light, pure and polluted, arrogant and humble. Architecturally there has been a search for creating implicit sacredness and deep-felt joy. The medium for such expression has been light, calligraphy, geometry, colour, garden and water. Only time will tell what new symbols will emerge as we mature out of the phase of indiscriminate imitation. As



17 Of orders, structures and hierarchies: Ishrat Khaneh, Samarkand, USSR.



18 Of orders, structures and hierarchies: morphological development of ISNA mosque, Plainfield, USA. Designed by the author.



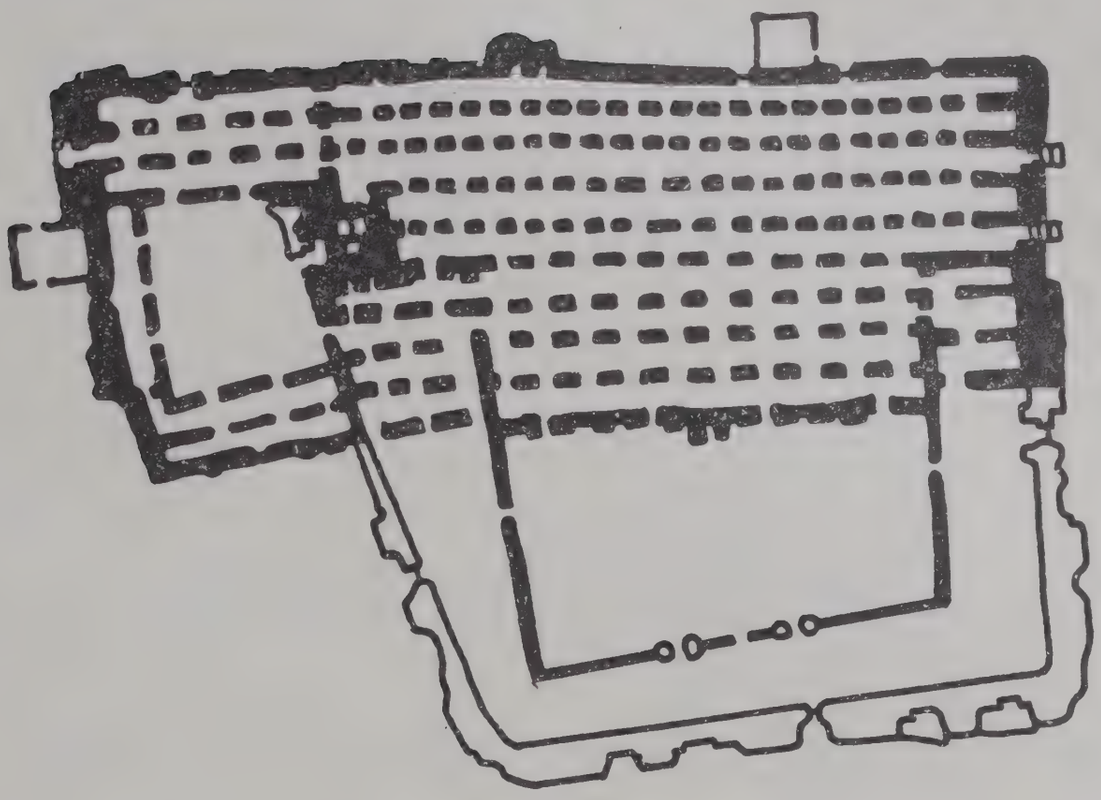
19 Of tradition, culture and identity: Suleymaniye Mosque, Istanbul, Turkey.

we get satiated with historic mimicking one hopes that we will rediscover the perennial aesthetic energy in the Islamic view of life and give it an expression in tune with our contemporary world of science, technology, information and global perspective. (Figs. 25, 26)

Conclusion

No proposal is free of the author's biases. No experiment can escape the influence of its methodology and no conclusion is entirely objective.

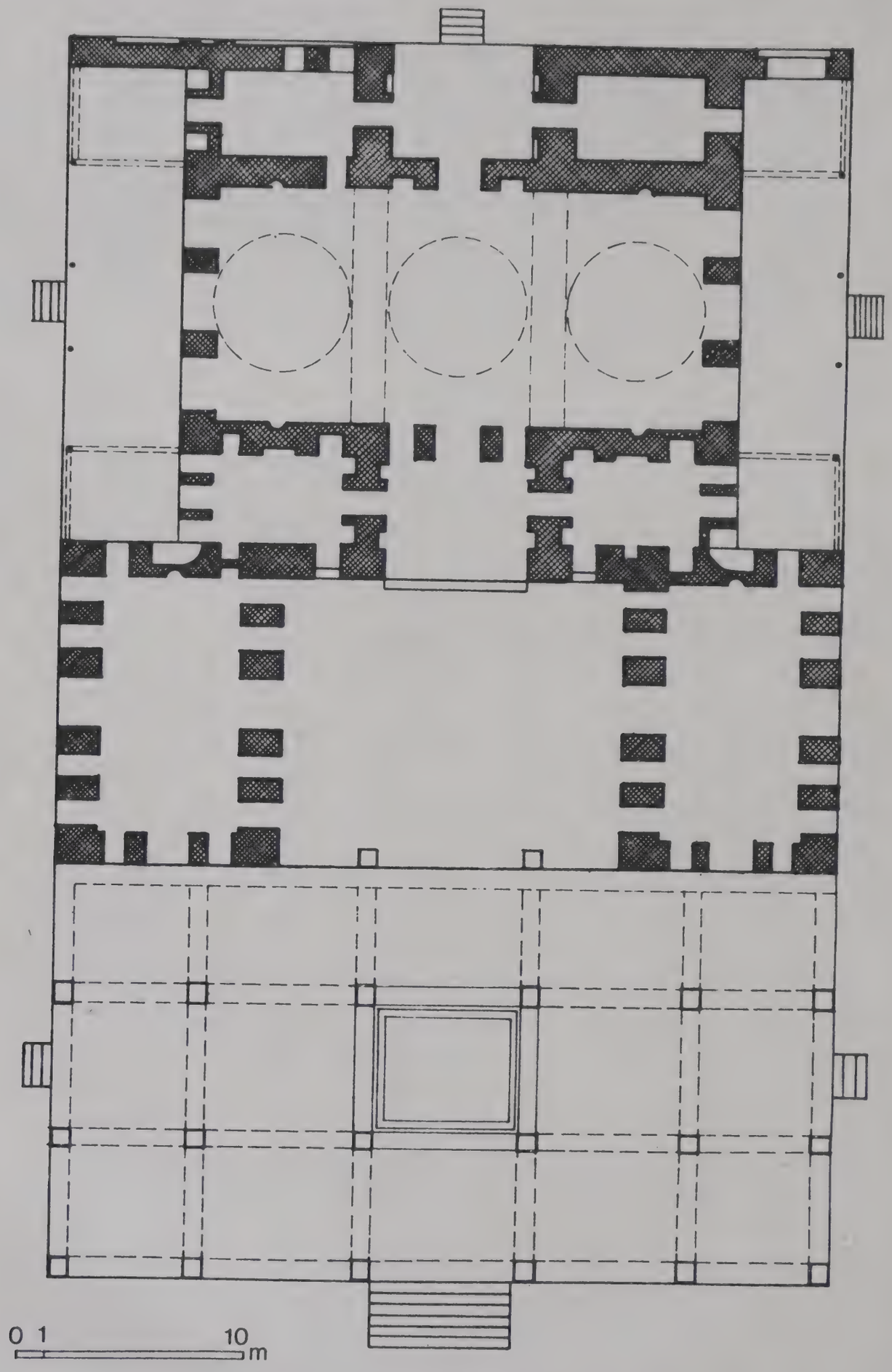
We belong to the scientific-technological epoch. Science claims to be pure, objective and independent of social morality. But this is not so. There are ample signs that left to itself science breeds its own kind of absolutism by promising a rational explanation of all phenomenon and a cure for all ills. Science and technology have become the major thought framework of our time. Not only do we perceive our problems in this framework but we seek solutions, construct explanations and even accept or reject the validity of any idea through it. We explain our current



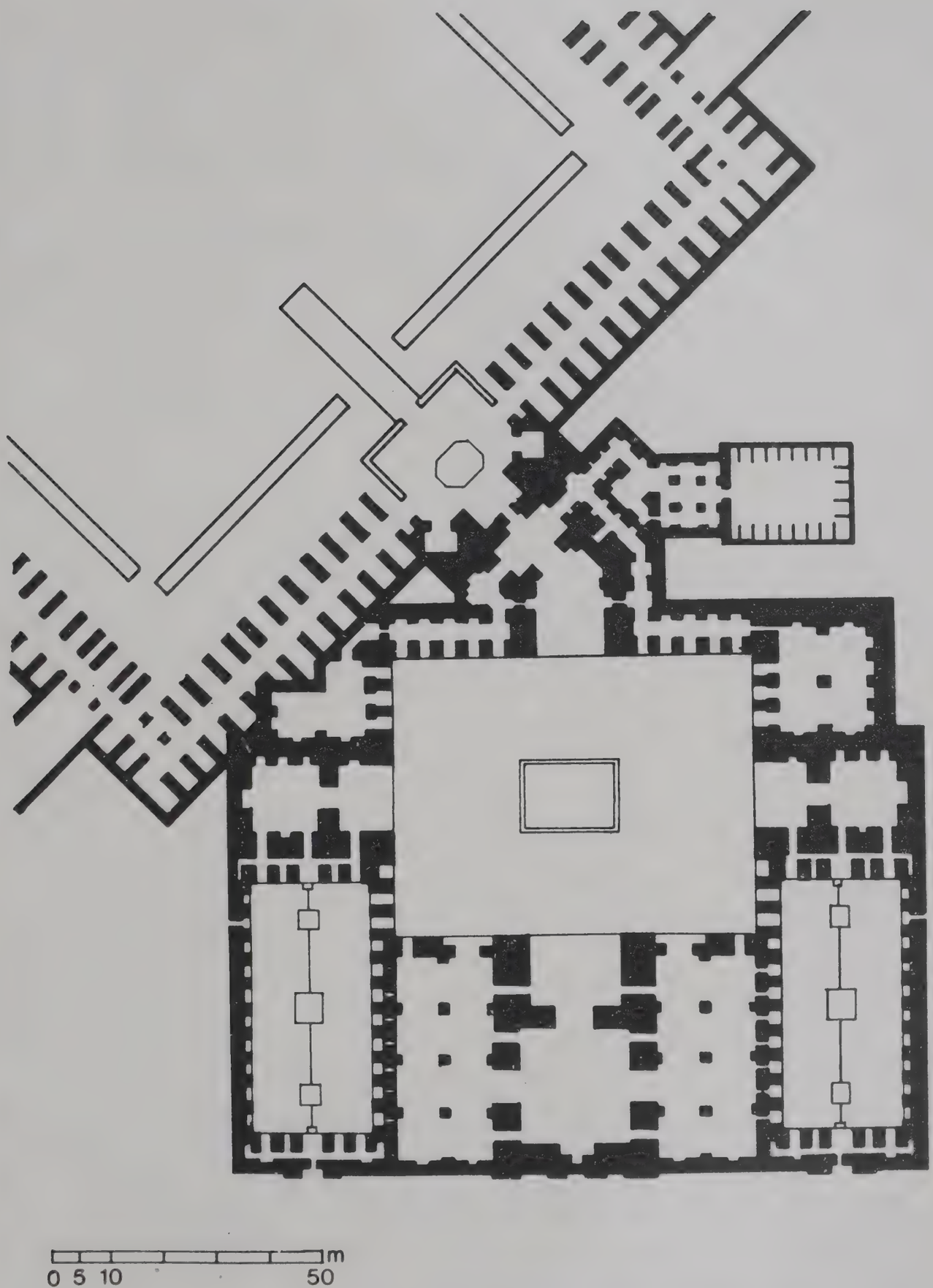
20 Of tradition, culture and identity: Great Mosque, Timbuktu, Mali, West Africa.

problems through game theories, econometric models and systems analysis. While we measure the advancement of our civilization by the scientific-technological breakthroughs we rationalise the misery of two-thirds of mankind by the complexity of political science and developmental economy. Through charts, statistics and probabilities we defend warfare technology in the name of peace, harmful drugs in the name of health and tranquillity, destruction of food in the name of price stability and acid rain in the name of economic necessity. And then the glamorous offspring of modern technology: the electronic mass communication, that promised us a global village, has instead created a powerful cult of world-wide hunger for refined goods through propagandist advertising. It can package and sell anything, a product, an idea or even a person for the 'proper returns'.

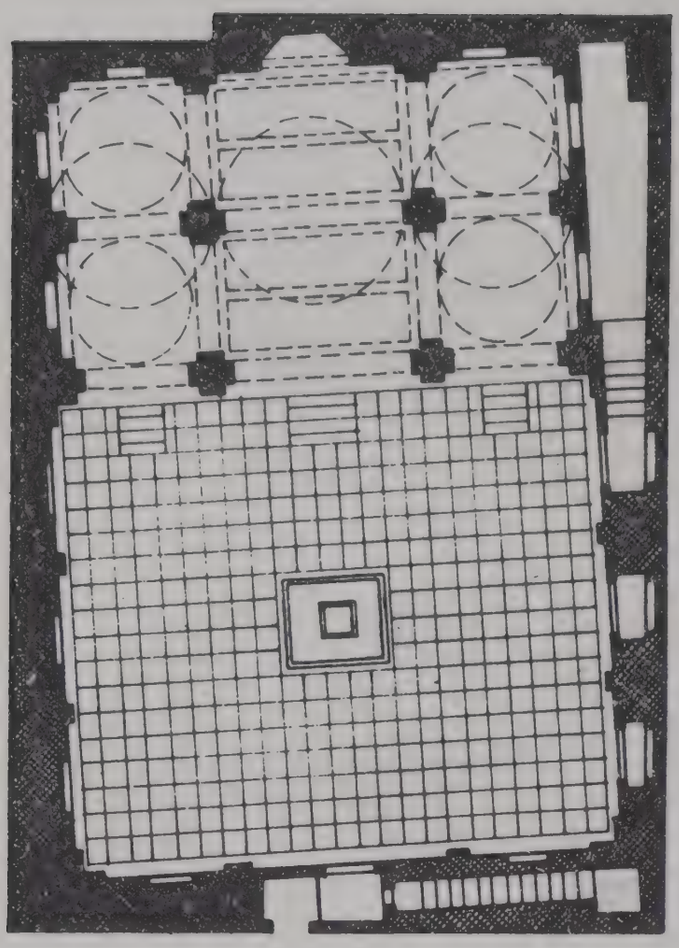
We need to harness or even replace the attitudinal biases of modern science and technology. But to come up with methodological alternatives to something that has been spreading over the past two centuries is an awe-inspiring task. It is too important to be left to an individual or a group, from the West or from the Islamic world. An extensive and sincere collaboration is required. The process models of *Ijma* (consensus) and *Ijtihad* (original thinking) as used by the inspired early generations of



21 Of elements, connections and meaning: Chaheel Situn, Isfahan, Iran.



22 Of elements, connections and meaning: Masjid-e-Shah, Isfahan, Iran.

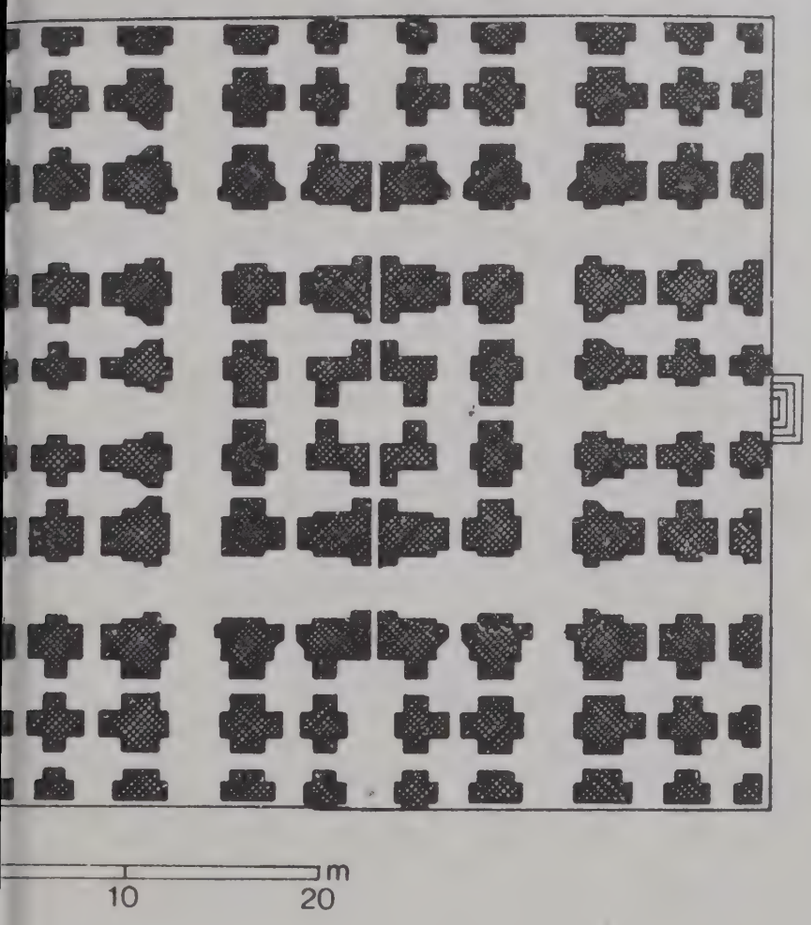


23 Of beliefs, emotions and sensations: the Pearl Mosque, Red Fort, Delhi, India.

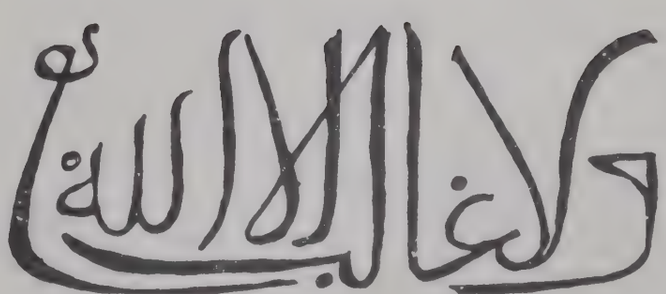
Muslims may have a guiding value for us in our search for new models and methods.

I would like to conclude by listing a few personal positions that might be catalytic in progress towards the environmental Ideal presented earlier in this essay:

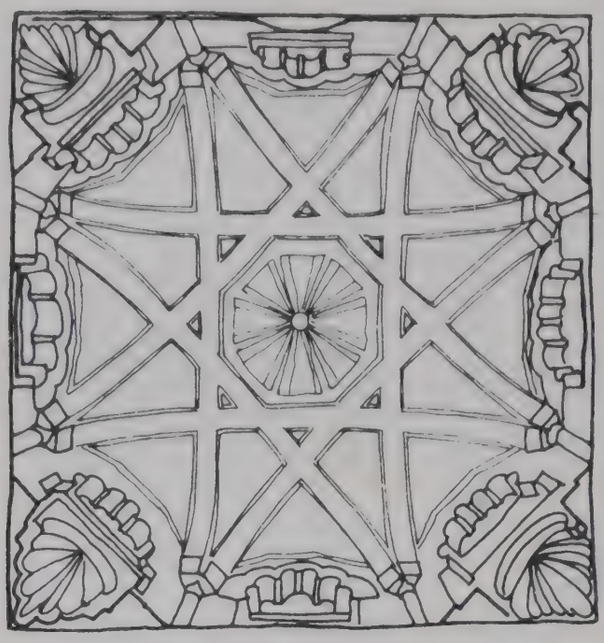
1 Every cure begins with the courage to recognise honestly the nature of disease. We need to recognise the failure of existing major world views of secular capitalism and materialistic socialism.
2 Simultaneity and inseparability of man, nature, ideas and institutions under One God is a more hopeful structural position than idiosyncratic plurality of mutually contradictory positions.
3 Instead of a Bill of Rights of Man we need a Matrix of Mutual Rights and Expectations among God, man and nature. God has rights over man, man has duties towards God, men have rights over each other, man has expectations from and rights over nature and nature must be given due rights over man.
4 Such a matrix may be sought through simultaneous interaction of the following six hierarchies discussed and debated in the light of a value framework like the one identified at the Stockholm Seminar:



24 Of beliefs, emotions and sensations. (*a. above*) Old City of Baghdad, Iraq; (*b. left*) Barradari of Sikandar Lodhi, Sikandra, India.



25 Of metaphors, allegories and symbols. (*a. left*) 'Muhammad' in rectangular Kufic, Samarkand, USSR; (*b. right*) 'Wa la Ghaliba illa-Llah': There is no victor besides God. Nasrid Inscription, Granada, Spain.



26 Of metaphors, allegories and symbols: Ceiling vaulting Pattern, Mosque of Cordoba, Spain.

a Hierarchy of man from individual to family, community, society, *Ummah* and mankind.
b Hierarchy of nature from simple organisms to global ecosystems.
c Hierarchy of man-made environment from dwelling to neighborhood, to cities, regions and nations.
d Hierarchy of needs from food, shelter, health, intellectual development, spiritual progress and selfhood in social plurality.
e Hierarchies of ideas from particular to general, rational to intuitive, partial to complete, individual to collective, temporal to eternal.
f Hierarchy of technological intensity from tactile craft to large scale automation to complex remote control robotics.

5 Finally, no charter, no declaration and no plan is worth the effort unless it is tested in the crucible of life.

References

1 Ziauddin Sardar, *The Future of Muslim Civilization*, Croom Helm, London, 1979; and *Science, Technology and Development in the Muslim World*, Croom Helm, London, 1977.
2 M. Nejatullah Siddiqui, *Banking Without Interest*, Islamic Foundation, Leicester, 1983 (second edition); and *Issues in Islamic Banking*, Islamic Foundation, Leicester, 1983.
3 R.B. Fuller, 'Conceptuality of fundamental structures' in Gyorgy Kepes (ed), *Structure in Art and in Science*, George Braziller, New York, 1965, p. 68.
4 Mohammad Asad, *The Spirit of Islam*, Islamic Foundation, Leicester, 1979, p. 7.
5 The Qur'ān, 13:15; see also 3:82, 16:48–50; 22:18; and 30:25–26.
6 S.H. Nasr, *Ideals and Realities in Islam*, Allen and Unwin, London, 1966, p. 42.
7 A saying attributed to Ali ibn Abi Talib.

8 Waqar A. Husaini, *Islamic Environmental Systems Engineering*, American Trust, Indianapolis, 1980, p. 16.
9 M. Asad, *Principles of State and Government in Islam*, University of California Press, Los Angeles, 1961, p. 102.
10 F. Rahman 'Islam: challenges and opportunities' in A.T. Welch and P. Cachia (eds.), *Islam: past influence and present challenge*, State University of New York Press, Albany, N.Y., 1979, p. 325.
11 Nasr, *op. cit.*, p. 93.
12 Husaini, *op. cit.*, p. 2.
13 I.R. Al-Faruqi, *Islamic studies*, II, June, 1963, p. 163.
14 S.H. Nasr, *Islamic studies*, Essays on Law and Society, The Sciences, and Philosophy and Sufism, Librairie Du Liban, Beirut, 1967, p. 61.
15 The Qur'ān, 53:39.
16 Nasr, *Ideals and Realities in Islam*, p. 29.
17 The Qur'ān, 3:39.
18 Asad, *The Spirit of Islam*, p. 15.
19 The Qur'ān, 35:28.
20 *Ibid*, 58:11.
21 Z. Sardar, 'Why Islam needs Islamic science', *New Scientist*, April 1982, pp. 25–28.
22 Ibn Hanbal, *Masnad*, Book 4, verse 133, 134.
23 'Ilm Al-Djamal', B. Lewis and others (eds.), *Encyclopedia of Islam*, Luzac and Co., London, 1971, vol. III, p. 1134.
24 S.H. Nasr, 'The contemporary Muslim and the architectural transformation of the urban environment of the Islamic world', Proceedings of The Aga Khan Award Seminar entitled, *Towards an Architecture in the Spirit of Islam*, Aga Khan Award, Geneva, 1978, p. 2.
25 A. Shariati, *On the Sociology of Islam*, (Translation Lectures by Hamid Algar) Mizan Press, Berkeley, 1979, p. 82.
26 Von Grunebaum, 'The Structure of the Muslim Town', in D.S. Wilson (ed), *Islam and Medieval Hellenism: Social and Cultural Perspectives*, Variorum Reprints, London, 1976, pp. IV-141–157.
27 O. Grabar, 'The architecture of The Middle Eastern city from past to present: the case of the mosque', in I.M. Lapidus (ed.), *Middle Eastern Cities*, University of California Press, 1969. pp. 26–46.
28 I.M. Lapidus, 'Muslim cities and Islamic societies' in Lapidus (ed.), *Middle Eastern Cities, op cit 1969*, pp. 47–79.
29 A.H. Hourani and S.M. Stern (eds.), *The Islamic City*, Bruno Cassiver, Oxford, 1970.
30 J. Abu-Lughod, 'Varieties of urban experience: contrast, coexistence, and coalescence in Cairo' in *Middle Eastern Cities*, edited by I.M. Lapidus, University of California Press, 1969 (pp. 159–87). Also see her paper 'Preserving the living heritage of Islamic cities', Proceedings of the Aga Khan Award Seminar entitled, *Towards an Architecture in the Spirit of Islam*, Geneva, 1978, pp. 27–35.
31 A. Adil-Ismail, 'Origin, ideology and physical patterns of Arab urbanization', Ph.D. dissertation, University of Karlsruhe, 1969.
32 S.M. Stern, 'The constitution of the Islamic city' in *The Islamic City*, ed. Hourani and Stern, Bruno Cassiver, Oxford, 1970, pp. 25–50.

33 S.D. Goitein, 'Cairo: an Islamic city in the light of Geniza documents' in *Middle Eastern Cities*, ed. I.M. Lapidus, University of California Press, 1969, pp. 50–96. Also see his discussions following Lapidus' presentation in the same book, pp. 74–5.

34 S.H. Nasr, see note 24.

35 J. Berque, 'An Islamic heliopolis?' Proceedings of The Aga Khan Award Seminar entitled, *Towards an Architecture in the Spirit of Islam*, Geneva, 1978, pp. 15–22.

36 N. Ardalan and L. Bakhtiar, *The Sense of Unity*, University of Chicago Press, 1973. Also see Ardalan's paper: 'Places of public gathering' in Proceedings of the Aga Khan Award Seminar entitled, *Places of Public Gathering in Islam*, Geneva, 1980, pp. 5–16.

37 C. Norberg-Schulz, *Genius Loci: Towards a Phenomenology of Architecture*, Rizzoli, New York, 1980, pp. 113–37.

38 S. Al-Hathloul, 'Urban forms in Arab-Muslim cities: physical elements or themes and principles', *Al-falsal*, Architecture and Planning Journal, Dammam, Saudi Arabia, Sept. 81, pp. 24–8.

39 Ali Safak, 'Urbanism and family residence in Islamic law', *Ekistics*, vol. 47, no. 280, Jan.–Feb. 1980, pp. 21–5.

40 J. Sauvaget, *Alep*, Paris, 1941; and 'Esquisses d'une histoire de la ville de Damas', *Revue des Etudes Islamiques*, no. 8, 1934, pp. 421–80.

41 Von Grunebaum, *op. cit.*, p. IV–155.

42 J.M. Rogers, 'Samarra: a study in medieval town-planning' in Hourani and Stern (eds.), *The Islamic City*, Oxford, Cassirer, 1970, pp. 119–155.

43 K. Fukushima, *The Utopian Project: In Search of the Altruistic Mirage; A Fifth Year Research and Development Project*, School of Architecture, Carleton University, Ottawa, 1982.

44 It would be instructive for the reader to search for correspondence between the coordinates of Islamic society and attributes of the City of Islam.

45 A remark attributed to Dr Hans Selye, author of well-known works, *Stress of Life* and *Stress without Distress*.

46 A.Y. Bokhari, 'Some notes on the development of contemporary Islamic architecture', *Ekistics*, vol. 47, no. 280, Jan.–Feb. 1980, pp. 76–7.

47 Bokhari,. *ibid.*, p. 76.

48 R. Arnheim, *Entropy and Art*, University of California Press, Berkeley, 1971.

PART FOUR

Approaching synthesis – issues and frameworks

II Knowledge, values and world-views: a framework for synthesis

JAMES STEVE COUNELIS

When discussing questions and issues of knowledge, scholars of differing cultural and religious backgrounds need to find a common understanding for ideas. These have to be at a level of abstraction above their own world-views and disciplines. This would be possible given enough time for a specific seminar group of scientists to tease out these common ideas[1]. This inductive work in some sense is like reinventing the wheel, though the educative experience for the interdisciplinary group of scientists and scholars would be invaluable to them personally. Philosophical scholarship provides useful conceptual tools for this purpose. The concepts of 'world-views' and 'disciplines' provide a framework which is one level above the cultural, religious and disciplinary characteristics of the scientists.

World-view defined

Holistically understood, all world-views contain four structural elements: cosmology, ethos, dynamic and telos (goals or ends).

By cosmology is meant the objective observations people make about their world and the pattern of meanings they impose upon them. For instance, the Copernican system, al-Biruni's universe, the Pantheon of classical Greece and Rome, the upper and lower jaw curriculum of the Polynesian *whare-wananga*, the nitrogen cycle, the Nicene-Constantinopolitan creed of 381 AD, RNA and DNA, and the Hawthorne effect are cosmological patterns imposed upon objectively observed realities at a given time and place by particular men. These imposed 'pictures' carry cognitive and affective meanings.

By ethos, is meant the values, evaluative methods and axiological structures attached to things and assigned to human behaviours. Political loyalty, the aesthetics of Bauhaus architecture and furniture, the nation-state system, Sufi teachings, marital fidelity, Aztec human sacrifices, mysticism and Orthodox Christian sacraments are illustrative of ethos, each example embodying value and moral or religious practice. Axiological rankings concerned with the just, equity and human rights, the beautiful, humanity and the commonweal, mercy and the good are included within ethos. Among the evaluative methods included in ethos would be those inspired by philosophical procedures, the Anglo-American concept of

legal precedence, games theory, simulation processes, the application of Bayesian premises and subjective utilities, along with the optomizing equations of linear programming.

Dynamics refers to principles of internal motion that 'make' the world view function as a psychic, social, physical and biological reality. Included within this are the three common laws of thermodynamics, Freud's id/ego/superego system of personality dynamics, Heisenberg's uncertainty principle, Newton's concept of gravity, and the Keynesian multiplier. Within Christian and Islamic world-views dynamics is provided by a Creator God and Revelation.

Telos is concerned with ordained purposes, goals and the ultimate. Among the examples of *telos* are Jefferson's well-turned phrase of the Declaration of Independence 'life, liberty and the pursuit of happiness', the Hippocratic oath, the canons of the American Bar Association, the continuation of the species through its reproductive system, and the Last Judgement within Islamic and Orthodox Christian eschatology.

Within physical time and space that is man's environment, worldviews are comprehensive in scope but never total or precise in detail. By means of commonsense, hypothesis, or science men impose order and boundaries upon the chaos selectively observed before them. Men assign meaning to their structured but partial views of the world in order to live within the realities around them without fear and paranoia. The stark reality of death – the obvious physical dissolution of physical man – is most feared. Men cope with death through *telos* in and through world-views.

In addition, a world-view is never a totally closed system. Further, no worldview is ever rigorously structured and none is ever pure in any ontological sense. The nature of man does not permit it. Some world-views, such as Orthodox Christianity and Islam, are theistic, while others, such as the radical Marxist, the Buddhist and the secular humanist, are non-theistic. Some are eclectic, idealist, rationalistic, realist, or empirical. Some are obliterative of man's nature and others are integrative of it. All worldviews evolve over time and generations.

Let me conclude this discussion by presenting a proposition. **Proposition 1** reads: a worldview is defined as a function of the intersect between cosmology and ethos held and practised by persons within the bounds of a particular time and place with the intersect directed towards particular goals or telos.[2]

Disciplines defined

Basically, there are two fundamental understandings related to the concept of disciplines: (1) discipline as knowledge; (2) discipline as the shaping of human behaviour – person or group – towards orderly self-controlled conduct. Each of these notions of discipline requires elaboration.

The notion of 'discipline as knowledge' is widely accepted today. But the basis for this understanding is not quite so evident. Knowledge in an ordered form, 'science', has been classified in accordance with the primary categories of data, form, method, and *telos*. The university curriculum contains datal disciplines such as history, physics, sociology and biology. Further, mathematics, grammar, logic and statistics illustrate the university curriculum in the formal disciplines. To these, one can add courses in literary criticism, archaeological excavation techniques, clinical pathology, group dynamics, questionnaire construction, and hydro-electric technology as methodological subjects. Ethics, public policy and decision-making, political economy, and eschatology are university disciplines concerned with social and religious ends – *telos*. A large number of persons have studied the problems of knowledge classification from many different viewpoints. But each attempt at classification required the natural *a priori* axiological decisions as to which category became the primary initiating one upon which finer judgements could be made for the whole range of human knowledge. The decision seems to revolve around the above-cited classes: data, form, method, *telos*. The table presents a range of representative persons in Western thought who have classified knowledge in accordance with one of these four fundamental definitional classes. For some of these classifiers, science or knowledge was one. For others, science or knowledge was many.

The understanding of Discipline as 'the shaping of human behaviour – person or group – towards orderly self-controlled conduct is one that is also quite common in most people's perception. Many images are conjured up by this view of discipline: (1) parental rearing of children; (2) the Marine Corps drill instructor in basic military training; (3) behavioural modification technology; (4) practice in psychomotor skills like athletics, dancing, musical instrument playing and surgery; (5) memorisation and drill processes; (6) group therapy seminars; (7) cultural saturation processes in foreign language education; (8) training in man/machine relations, e.g. pilot training simulators and typewriting; (9) taste development in foods, dress, etiquette, home decor, performing arts appreciation and social *savoir faire*; (10) team development for complex tasks in medicine, science, military tactics, and organisational achievement of delimited goals. Though all of these examples reflect behavioural shaping towards orderly self-controlled conduct, there is no known classification scheme for disciplines in this sense. These examples would be usually placed under the rubric of 'method' given above. And yet, discipline in this sense of human behaviour-shaping being *praxis* should have a classification scheme of its own.[3]

One of our contemporary commonplaces in research and the university

[*continued on p. 221*

A typology of discipline classification schemes

Defined Discipline bases	*Examples of discipline classification schemes*	
	Sources	*Principles*
I *Data*	Ampère	Sciences cosmologiques/Sciences noölogiques[1]
	St Thomas Aquinas	Speculative sciences: natural philosophy (science), mathematics, theology (metaphysics)[2]
	Bentham	Eudomonics: art and science of wellbeing[3]
	Bunge	Formal sciences/factual sciences[4]
	Burdach	Wissen/Handeln/Durch Wissen bestimmtes Handein[5]
	Campbell	Fish-scale model of omniscience[6]
	Coleridge	Encyclopaedic disciplines: (1) pure sciences – formal + real; (2) mixed/applied sciences + fine arts; (3) biography, history, chronology, geography; (4) miscellaneous + an etymological/ philosophical lexicon of the English language[7]
	Comte	Natural philosophy/moral philosophy[8]
	Cournot	A 3 × 5 discipline matrix[9]
	Dewey decimal system	Discrete subject categories[10]
	Foskett	Precoordinate indexing of documents/ postcoordinate indexing by item or term[11]
	Hobbes	Sense and memory/science[12]
	Hugh of St Victor	Philosophy: theoretical, practical, mechanical, logical[13]
	Leibnitz	Physics/ethics/logic[14]
	Locke	Physics/ethics/semiotic[15]
	Makrakis	God/world/man[16]
	Morse	Hierarchy of sciences: matter, humanity, and norm or idea[17]
	Naville	Sciences of law (*théorématique*), sciences of facts (*histoire*), sciences of rules (*canonique*)[18]

A typology of discipline classification schemes—*continued*

Defined Discipline bases	*Examples of discipline classification schemes*	
	Sources	*Principles*
	Ouspenky	Four forms of consciousness and their knowledges[19]
	Papanoutsos	Sciences and philosophy of nature/ sciences and philosophy of culture[20]
	Park	Noölogy and cosmological sciences[21]
	Pearson	Abstract knowledge/concrete knowledge[22]
	Plato	The divided line: visual and intellectual realms[23]
	Sherrer	Ontology of disciplines[24]
	Spencer	Abstract knowledge/concrete knowledge[25]
	Stanley	Hierarchy of disciplines: ontological and abstractive integrating principles[26]
	Thomson	Natural sciences (including anthropology)/religious sciences/ political and social sciences[27]
	Wundt	Philosophy/unified knowledge[28]
II *Form*	Alpha-numeric series	Serial and coding processes
	Churchman	Inquiring systems: Leibnitzian, Lockean, Kantian, Hegelian, and Singerian[29]
	Eggen	System models of knowledge[30]
	Gregg	Taxonomic logic[31]
	Hooper	A 2 × 2 matrix of science: concrete/ abstract dimension × generalizing/ specializing dimension[32]
	International Encyclopaedia of Unified Science	Formal, symbolic and syntactic analyses of scientific propositions[33]
	Kant	'Architectonic'[34]
	Levi	Intuitive logics: Bayesian entailed proposition sets[35]
	Meredith	PJQR tetralectic model[36]
	Parsons	Belief systems: scientific, ideological, philosophic, religious[37]

A typology of discipline classification schemes—*continued*

Defined Discipline bases	*Examples of discipline classification schemes*	
	Sources	*Principles*
	Piper and Ward	Sciences as systems: theoretical, practical and aesthetic[38]
	Werkmeister	Types of propositional truth: (1) semantic/syntactical; (2) systemic; (3) empirical[39]
III *Method*	Bacon	Empirical method[40]
	St Bonaventure	*Lumen exterius:* mechanical arts; *lumen inferius:* sense perceptions; *lumen interius:* philosophical knowledge; *lumen superius:* theological knowledge[41]
	Communist science	Dialectic of nature (Engels) vs. dialectic of consciousness (Hegel and the Frankfurt School)[42]
	Counelis	Science as process and product: theory of intellective action; theory of axiology; theory of ontology; theory of forms[43]
	Descartes	Modal mathematical logics[44]
	Dewey	'Inquiry'[45]
	Fichte	Intellectual/psychological dialectics: thetic, antithetic and synthetic processes[46]
	Foucault	Thought *vs.* actional knowledge: consciousness/conaissance/science *vs.* discursive practice/Savoir/science[47]
	Maslow	Experimental knowledge/spectator knowledge[48]
	Mill	Inductive and deductive logic[49]
	Oliver	Classificatory and functional organisations of knowledge[50]
	Royce	Epistemic processes: rationalism, metaphorism, empiricism[51]
	Schopenhauer	Principle of sufficient reason: four types of explanatory thought processes: physical, logical, mathematical, moral[52]

A typology of discipline classification schemes—*continued*

Defined Discipline bases	*Examples of discipline classification schemes*	
	Sources	*Principles*
	Shestov	Athens (reason) *vs.* Jerusalem (faith)[53]
	Shields	'Scientific unity of knowledge'[54]
	Thelen	Models of education: personal inquiry; group investigation; reflective action; skill development[55]
	Blessed Theodore	Natural knowledge/supernatural knowledge[56]
	Tykociner	Zetetics and zetesis[57]
IV *Telos*	Cassiodorus	Sacred and profane literature[58]
	St John Damascene	Eschatology[59]
	Gephart	Model for profiling completed research[60]
	Hegel	'The absolute'[61]
	Helmstadter	Taxonomy of behavioural science research[62]
	Phenix	General education: unity of studies and life view[63]
	Radnitzky	Schools of metascience: logical empiricist and hermeneutic/ dialectical[64]
	Seneca	Human development arts: (1) manual crafts; (2) scenic arts; (3) pupillary arts (encyclopaedic knowledge); (4) liberal arts (arts of liberty) and development of virtue[65]

References for table

1 André-Marie Ampère, *Essai sur La Philosophie des Sciences, ou Exposition Analytique d'une Classification Naturelle de toutes les Connaissances Humaines*, Chez Bachellier, Paris, 1834.

2 St Thomas Aquinas, *The Division and Methods of the Sciences: QQ. V–VI of His Commentary of the De Trinitate of Boethius*, translated by Armond Mauer, 3rd rev. ed., The Pontifical Institute of Mediaeval Studies, Toronto, 1963

3 Jeremy Bentham, 'Chrestomathia' and 'Essay on nomenclature and classification', in John Bowning (ed.), *The Works of Jeremy Bentham*, reprint ed.; New York: Russell and Russell, Inc., New York, 1962, vol VIII, pp. 63–126.

4 Mario Bunge, *Scientific Research I: The Search for System*, Springer-Verlag New York, Inc., 1967, pp. 21–25.

5 Karl F. Burdach, *Der Organismus menschlicher: Wissenschaft und Kunst*, Mitzky und Comp., Leipzig, 1809.
6 Donald T. Campbell, 'Ethnocentrism of Disciplines and the Fish-Scale Model of Omniscience', in Muzafer Sherif and Carolyn W. Sherif (eds.), *Interdisciplinary Relationships in the Social Sciences*, Aldine Publishing Company, Chicago, 1969.
7 Samuel T. Coleridge, 'Treatise on Method' as published in the Prospectus of the *Encyclopedia Metropolitana*, Constable and Company Ltd., London, 1934, pp 71–9.
8 Auguste Comte, *System of Positive Philosophy*, translated by Richard Congreve, Carilian-Goeury/V. Dalmont, Paris, 1854), IV, pp. 160–218.
9 Anton Augustine Cournot, *An Essay in the Foundations of Our Knowledge*, translated by Merritt H. Moore, The Liberal Arts Press, New York, 1956, pp. 500–501.
10 Melvil Dewey, *Dewey Decimal Classification and Relative Index*, 2 vols, 17th ed., Forest Press, Inc., New York, 1965.
11 A. C. Foskett, *The Subject Approach to Information*, 2nd rev. enl. ed., Linnet Books, Hamden, 1971.
12 Thomas Hobbes, *Leviathan, or The Mtter, Forme, and Power of a Commonwealth – Ecclesiastical and Civill*, Andrew Cooke, London, 1651, ch. IX.
13 Jerome Taylor (trans. and ed.), *The Didascalicon of Hugh of St. Victor: A Medieval Guide to the Arts*, Columbia University Press, New York, 1961, p. 62 [Book II, ch. 1].
14 Gottfried W. von Leibnitz, *New Essays Concerning Human Understanding*, translated by Andrew G. Langley, The Macmillan Company, New York, 1896, ch. XXI.
15 John Locke, 'Essay on Human Understanding', in *The Works of John Locke*, reprint ed. of 1832 ed., Scientia Verlag Aalen, Darmstadt, 1963, vol. III, pp. 174–6.
16 Apostolos Makrakis, *A New Original Philosophical System*, G.P. Putnam and Sons, New York, 1940, vol I, pp. 32–3.
17 Sidney Morse, *A Map of the World of Knowledge*, The Arnold Company, Baltimore, 1926.
18 Adrien Naville, *Classification des Sciences: Les Idées Maitresses des Sciences et leur Rapport*, Librairie Felix Alcan, Paris, 1920.
19 P.D. Ouspensky, *Tertium Organum: The Third Canon of Thought*, translated by Nicholas Bassaraboff and Claude Braddon, Vantage Books/Random House, New York, 1920, 1950, 1970.
20 Evangelos P. Papanoutsos, *The Foundations of Knowledge*, State University of New York Press, Albany, 1968.
21 Roswell Park, *Pantology* . . ., Hogan and Thompson, Philadelphia, 1841.
22 Karl Pearson, *The Grammar of Science*, J.M. Dent and Sons Ltd., London, 1937, pp. 320–35.
23 Plato, *The Republic*, vi, pp. 507c6–511e5.
24 Eduard Scherrer, *Wissenschaftslehre: Ordnung und Wesen de Wissenschaften*, Verlag Paul Haupt, Bern, 1966.
25 Herbert Spencer, 'The Classification of the Sciences', in *Recent Discussions in Science, Philosophy and Morals*, D. Appleton and Company, 1890, New York, pp. 63–86.

26 H.M. Stanley, 'On the Classification of the Sciences', *Mind*, vol. IX (1884), pp. 265–74.
27 M. James Thomson, *Principe de Science Absolue*, J. Rothschild, Paris, 1875.
28 Wilhelm Wundt, *Logik: Eine Untersuching der Prinzipen der Erkenntnis under der Methoden Wissenschaftslicher Forschung*, Verlag von Ferdinand Enke, Stuttgart, 1920, vol. II, chs. 2–3.
29 C. West Churchman, *The Design of Inquiring Systems: Basic Concepts of Systems and Organization*, Basic Books, Inc., New York, 1971.
30 J.B. Eggen, 'System Models of Knowledge', *General Systems*, vol. XXI (1976), pp. 169–73.
31 John R. Gregg, *The Language of Taxonomy: An Application of Symbolic Logic to the Study of Classificatory Systems*, Columbia University Press, New York, 1954.
32 Charles E. Hooper, *The Anatomy of Knowledge*, Watts and Company, London, 1906.
33 Otto Neurath, *et. al.*, *International Encyclopedia of Unified Science*, The University of Chicago Press, Chicago, 1955, 2 parts.
34 Immanuel Kant, *The Critique of Pure Reason*, Encyclopaedia Britannica, Inc., Chicago, 1952, pp. 243–8.
35 Isaac Levi, *Gambling with Truth: An Essay on Induction and the Aims of Science*, M.I.T. Press, Cambridge, Mass., 1967.
36 Patrick Meredith, *Instruments of Communications: An Essay on Scientific Writing*, Pergamon Press, Oxford, 1966.
37 Talcott Parsons, *The Social System*, The Free Press, Glencoe, Ill., 1951, ch. 7.
38 Raymond F. Piper and Paul W. Ward, *The Fields and Methods of Knowledge: A Textbook in Orientation and Logic*, F. S. Crofts and Company, New York, 1939, ch. XVI.
39 W.H. Werkmeister, *The Basis and Structure of Knowledge*, reprinted., Greenwood Press, New York, 1968.
40 Francis Bacon, *The New Organon and Related Writings*, edited by Fulton H. Anderson, Library of Liberal Arts no. 97; Bobbs-Merrill Company, Inc., 1963.
41 Sr Emma T. Healy, *Saint Bonaventure's De Reductione Artium ad Theologiam ...*, Saint Bonaventure College, New York, 1940.
42 Thomas A. McCarthy and Karl G. Ballestrem, 'Science', in C. D. Kering (ed.), *Marxism, Communism and Western Society: A Comparative Encyclopedia*, Herder and Herder, New York, 1973, vol VII, pp. 274–304.
43 James Steve Counelis, 'The Holistic Description of A College Faculty with a Brief Excursus on Methodology', in Clarence H. Bagely (ed.), *Design and Methodology in Institutional Research: Proceedings of the Fifth Annual National Institutional Research Forum, State University of New York at Stoney Brook, May 3–4, 1965*, Washington State University/Office of Institutional Research, 1965, pp. 85–96.
44 René Descartes, 'Rules for the Direction of the Mind' and 'Discourse on the Method of Rightly Conducting Reason', in *The Philosophical Works of Descartes*, translated and edited by Elizabeth S. Haldane and G.R.T. Ross, Dover Publications, Inc., New York, vol II, pp. 1–130.
45 Melvil Dewey, *Dewey Decimal Classification and Relative Index*, 2 vols, 17th ed., Forest Press, Inc., New York, 1965.

46 Peter Heath and John Lachs (ed./trans.), *Fichte: Science of Knowledge*, Appleton-Century-Crofts, New York, 1970.
47 Michel Foucault, *The Archeology of Knowledge*, Randon House/Pantheon Books, New York, 1972.
48 Abraham H. Maslow, *The Psychology of Science: A Reconnaissance*, Henry Regnery Company, Chicago, 1966.
49 Ernest Nagel (ed.), *John Stuart Mill's Philosophy of Scientific Method*, Hafner Publishing Company, New York, 1950, New York, pp. 211–38.
50 W. Donald Oliver, *Theory of Order*, The Antioch Press, Yellow Springs, Ohio, 1951, ch. 15.
51 Joseph R. Royce, 'The Present Situation in Theoretical Psychology', in Benjamin B. Wolman (ed.), *Handbook of General Psychology*, Prentice-Hall, Inc., Englewood Cliffs, N.J., 1973, ch. 2.
52 Arthur Schopenhauer, *On the Fourfold Root of the Principle of Sufficient Reason*, translated by E.F.J. Paine, Open Court Publishing Company, LaSalle, Ill., 1974.
53 Lev Shestov, *Athens and Jerusalem*, translated by Bernard Martin, Ohio University Press, Athens, Ohio, 1966.
54 Charles W. Shields, *The Order of the Sciences: An Essay on the Philosophical Classification and Organization of Human Knowledge*, Charles Scribner's Sons, New York, 1882.
55 Herbert A. Thelen, *Education and the Human Quest: Four Designs for Education*, The University of Chicago Press, Chicago, 1960, 1972.
56 The Blessed Theodore, 'Theoretikon', in E. Kadloubovsky and G.E.H. Palmer (eds.), *Early Fathers from the Philokalia*, Faber and Faber, Ltd., London, 1954, pp. 388–98.
57 Joseph T. Tykociner, 'Zetetics and the Areas of Knowledge', in *Education and the Structure of Knowledge*, Rand McNally and Company, Chicago, 1964, ch. IV.
58 Cassiodorus Senator, *An Introduction to Divine and Human Readings* [*Institutiones divinarum et humanarum lectionum*], translated by Leslie W. Jones, Columbia University Press, New York, 1956.
59 St John Damascene, *Writings* [*Fount of Knowledge*], translated by Frederic H. Chase, Jr., Fathers of the Church, Inc., New York, 1958.
60 William J. Gephart, 'Profiling Completed Research', in *Application of the Convergence Technique to Basic Studies in Reading* (USOE Project No. 8-0737) Phi Delta Kappa, Bloomington, Ind., 1970, pp. 207–23.
61 W.H. Johnston and L.G. Struthers (trans.), *Hegel's Science of Logic*, George Allen and Unwin Ltd., London, 1951, 2 vols.
62 G.C. Helmstadter, *Research Concepts in Human Behavior: Education, Psychology, Sociology*, Appleton-Century-Crofts, New York, 1970, pp. 27–38.
63 Philip H. Phenix, *Realms of Meaning: A Philosophy of the Curriculum for General Education*, McGraw-Hill Book Company, Inc., New York, 1964.
64 Gerard Radnitzky, *Contemporary Schools of Metascience*, 3rd ed.; Henry Regnery Company, Chicago, 1973.
65 Seneca, 'Letter No. 88,' in *Seneca's Letters to Lucilius*, translated by E. Phillips Barker, The Clarendon Press, Oxford, 1932, vol. II.

curriculum is to speak of certain areas as being interdisciplinary. And when one looks at these academic fields, the variety and number of interdisciplines appears legion. But at the level of structure, there appear to be only three generic patterns of interdisciplines. Using the notions of 'discipline as knowledge' and 'discipline as human behaviour-shaping towards orderly self-controlled conduct', these patterns will become clear.[4]

The first type of interdiscipline occurs when two or more sciences come together, the nature of their intersect not generically specified. Examples are biology and chemistry in biochemistry, mathematics and sociology in mathematical sociology, and psychology with linguistics in psycho-linguistics.

Our discussion on first type of disciplines can now be summarised as **Proposition 2:** Type I interdiscipline is defined to be a function of the intersect of two or more sciences guided by the intent or purpose of the interdiscipline. As noted above, all disciplines contain an axiological component that directs and undergirds its processes towards given ends.

Type II interdisciplines are not new to the educational scene. This type is characterised when two or more human behaviour-shaping disciplines are brought together for specific training purposes. In every field of endeavour one finds this Type II interdiscipline. Some examples are: (1) medical technology and public health techniques; (2) parliamentary procedures and group decision-making processes; (3) the good sportsmanship ethic and university/professional athletics; (4) police training and human relations methods; (5) yoga exercises and meditation. The generic form of Type II interdiscipline is given in **Proposition 3** which reads: Type II interdiscipline is defined to be a function of the intersect of two or more behavioural shaping disciplines guided by the intent or purpose of the interdiscipline.

Type III interdisciplines are found in all university-based curricula for the professions. This third type of interdiscipline is characterised by the practical intersect of one or more branches of knowledge with one or more disciplines in human behaviour-shaping. The following are examples: (1) the training and practice of doctors and nurses in the problems and techniques appropriate to the treatment of the dying; (2) the training and practice of risk-orientated administrators through a combined in-service role, the scientific study of organisational theory and administration, and the personal study and integration of his philosophy of life and work style; (3) simulation games of war, financial investment, the firm, or school administration; (4) a course connecting racial and ethnic relations to sensitivity training; (5) pastoral counselling for the ministry to the dying and bereaved, the recidivist criminal, the drug addict, the homosexual, and anyone under stress. These examples illus-

trate the specific intersect of theory, science and *praxis*. The generic design for Type III interdiscipline is given in **Proposition 4:** which reads: Type III interdiscipline is defined to be a function of the specific intersect of one or more branches of knowledge with one or more human behaviour shaping disciplines, guided by the intent or purpose of the interdiscipline.

Having defined the concepts of world-view and disciplines and inter-disciplines, we need to identify their relationship to each other.

Worldviews and disciplines

All disciplines are in a hierarchically subordinate relation to worldviews for several reasons. The first is that knowledge as categorised in particular world-views is much more abstract than the generalisations arrived at from a set of data in a particular discipline. Secondly, the values and goals of a particular world-view are generic, and those within disciplines are particular to the disciplines themselves. Hence, disciplinary ends are limited. And lastly, all disciplines develop within a particular historical milieu making them bound to space and time. However, world-views transcend time and space.

Some important inferences stem from this hierarchical relation between world-views and disciplines. One inference is that disciplines can provide important infrastructural detail about the cosmos, thus elucidating those areas on which a worldview is vague or silent. Another inference is that scientific and technological disciplines expand the range of available alternatives for mankind. The influence of both the cosmological details and expanded alternatibes discovered by the disciplines has a significant impact on worldviews. Gamow's 'big bang' theory and contemporary extrapolations of Darwinian evolution are certainly challenges to theistic relations such as Islam and Christianity with their theologies of a Creator God and Revelation. For these religions, industrial, military and medical technologies challenge their moral and religious values on such issues as the ethics of environmental health and the economy, atomic warfare and the values of 'just war' and *Jihad*, the definitions of life and death in relation to abortion and the removal of life-support equipment from the ill.

Theories of the origin of the universe (cosmogony) and the ultimate purpose of man will ever be the points where worldviews and disciplines mutually inform each other, working out collectively their own updates over time. There is vast history and experience in virtually every era, country and culture of such updates. Ian Barbour in his *Issues in Science and Religion* has catalogued some of these in Western culture[6] and Seyyed Hossein Nasr does the same in his excellent *An Introduction to Islamic Cosmological Doctrines*.[7] Additionally, I have been doing the same for Eastern Orthodox Christianity.[8]

Thus, it is clear that the intersect between worldviews and the disciplines provides a basic framework for the specific discussion on knowledge and values: a framework that could be usefully used to produce a synthesis between Islamic and Western approaches to science and technology.

Knowledge and values

Cosmogony and ultimate ends are issues of discussion within a worldview. On the one hand, particular bits of knowledge and specific moral issues relating to the cosmological, ethotic and telic orientation of the worldview become the main issues, while on the other hand they also form the content and delineate boundaries for this discussion. Here the elements of Proposition 1 are useful in constructing the form of that intra-worldview debate, namely whether the particular bits of knowledge or specific moral issues are within the epistemic framework of a given worldview. To put it another way – and this is my **Proposition 5:** intra-worldview criterial discourse is a function of a comparative and contrastive study of a particular bit of knowledge or moral issue in relation to the appropriate epistemic element within the worldview. For example, atomic warfare in relation to the Christian notion of 'just war' and the Islamic notion of *Jihad* would follow such a generic intra-worldview criterial debate. Also, Gamow's 'big bang' theory in relation to Islamic and Christian theologies of a Creator God and Revelation would follow this identical argument.

We have seen that the concepts of 'knowledge' and 'values' were clarified through the generically defined notions of world-views and disciplines. Proposition 5 provides a epistematic framework for the discussion between world-views and specific knowledges and/or values. This presentation will, it is hoped, aid the appropriate updates between the worldviews and the disciplines. Given the rapid epistemic changes and the contributions that contemporary disciplines make to these changes, all world-views have a responsibility to respond to them.

Sociobiology: an example

As an illustration of the power of this framework for discussion and synthesis, consider the example of sociobiology which is among the most recent of the coalescing disciplinary descriptions of man. It has been primarily championed by Edward O. Wilson in his *Sociobiology: a New Synthesis* and *On Human Nature*. Currently, it is too early to perceive whether a Kuhnian paradigm is in the making with Wilson codifying it.[9]

Wilson defines Sociobiology as 'the systematic study of the biological basis for all social behaviour', eventually to include the Humanities which would be the last disciplines to be 'biologised'. At present, however,

sociobiology mainly focuses upon animal societies, their genetic and populational structures, castes, communication and the physiology underlying social adaptations. Further, Sociobiology is concerned with the social behaviour of early man and the adaptive features of organisation found in more primitive contemporary societies.

Wilson wrote the following on the central precept of Sociobiology:

> ... Its central precept is that the evolution of social behaviour can be fully comprehended only through an understanding, first, of demography, which yields that vital information concerning population growth and age structure, and, second, of the genetic structure of populations, which tells us what we need to know about effective relationships within the societies, and the amount of gene flow between them. The principal goal of a general theory of sociobiology should be the ability to predict features of social organization from a knowledge of these population parameters combined with information on the behavioral constraints imposed by the genetic constitution of the species. It will be the chief task of evolutionary ecology, in turn, to derive the population parameters from a knowledge of the evolutionary history of the species and of the environment in which the most recent segment of that history unfolded. The important feature ... is the sequential relation between evolutionary studies, population biology, and sociobiology.[10]

The complexity and immense detail of Wilson's synthesis cannot be provided here. But recognising that the general trend of his synthesis is based upon the last century or so of research in crossphyla and intraphyla studies of animals and man, my emphasis will be to understand what I will call Wilson's 'Concept of the Natural Man' – a social creature whose social and human behaviour is significantly entailed in and by his bio-ecological nature.

According to Wilson, the prime movers of social evolution are: (1) phylogenetic inertia; (2) ecological pressure. As a result, short-term social/behavioural adaptations are by individual organisms. For man, the capacity to learn and to change social structure such as the family and government represent such short-term changes. However, long-term changes occur within a population or a species. Popularly, this is called evolution. Examples of these in man are the heights of pygmies, racial skin colours, and the size of the brain. The responses to these two prime movers of social evolution are certain classes of social mechanisms that are found cross-phyla. Wilson lists the following eleven: (1) group size, reproduction, and time-energy budgets; (2) environmental tracking mechanisms; (3) communication; (4) group/kin selection and altruism: (5) aggression; (6) social spacing, including territoriality; (7) dominance systems; (8) roles and castes; (9) sex; (10) family and parenting; (11) symbiosis. These social

mechanisms, found in various combinations and permutations in all animal groups, provide the individual and species response sets.

In viewing man, Wilson sees him at the top of the social evolutionary scale with an *n*-dimensional capacity to relate and respond. Man is ecologically unique. Of all the primates, man has the widest geographic distribution and the highest populational density. Perhaps at one time in Africa, *Homo* coexisted with other hominids; but today, man is the only surviving species.

Anatomically evolved into a unique form, man has erect posture. He has long-legged bipedal locomotion. Man has an enlarged brain of immense complexity. His hands have lengthened digits with a mechanically useful opposing thumb. His hair loss, though not accountable, is remarkable. Through evolutionary development, the oestrus cycle has been altered into a pattern of periodic heavy menstruation and virtually continual sexual activity. Man has developed true language and culture. The plasticity of human adjustment is phenomenal as a result of that culture and his brain. Wilson suggests that there is evidence to believe that some aspects of human culture are gene-connected. He cites the moderate heritability found in measures of introversion/extroversion, personal tempo, psychomotor skills and sports activity, neuroticism, dominance, depression, and even the tendency towards some mental illnesses such as schizophrenia. With reference to this issue of heritability, there has been considerable controversy over Sociobiology, particularly in the light of current worldwide concern over equality for persons of all racial and ethnic minorities.[11]

Man shares a number of traits with the other primates. Of particular interest are the gender-centred traits that are shared. There is a group of five such gender-related traits. The male-centred group of traits consists of the following: (1) attention structure centripetal upon the males; (2) aggression dominance with males over females; (3) involvement of males in the parental care of the young. The female-centred traits are: (1) prolonged maternal care of the young with pronounced socialisation of the young; (2) matrilineal organisation. Certainly these gender-related traits in primates have been altered in the more advanced societies. The virtual continuous capacity for sexual activity leads to pair-bonding marriages; however, the division of labour between the genders is unique to man. The current neutering of occupational roles is an extension of this human trait to divide the labour between the genders. And the current Western Christian interest in the introduction of women into the clergy is well within this universal human trait. But within this context, the unique human state is more than gender-related. Wilson argues that true language and elaborated culture are unique to man, along with incest taboos and formalised marriage exchange rules that recognise kinship networks.

Hence it is the sum of these unique human traits that seem entailed in and by the traits that are shared with other primates which constitutes the partial image of man that Wilson constructs for all to ponder.

Within Wilson's framework, culture and traditions are environmental tracking mechanisms through which man is able to survive, cybernetically. He monitors his bio-social environment and adjusts his behaviour for survival, be it crossing the street, telling a lie, changing his clothes, voting for public officials, hunting for food or a mate, or writing a doctoral dissertation. Human institutions, which for Wilson includes religions, further the welfare of the participants. The plasticity of human behaviour is both a strength and a weakness, especially when there is a tendency for individual and in-group survival. In particular, Wilson cites the same fact that Berelson and Steiner cited in 1963: namely, that man is a most indoctrinable creature and does not seek the truth. In another context, I alluded to this same human trait as the Ananias syndrome, namely, man as a seeker of deceptions of himself and others as well as a seeker of truth when he pursues personal satisfaction.[12]

From his sociobiological viewpoint, Wilson presents an ingenious and complex account of human aesthetics, Kohlberg's schema of moral judgements in human development, territoriality, tribalism, and a two-stage theory of man's mental development. This latter theory is devised to account for complex social organisations, agriculture, increased population densities, the exponential curve of inventions and human knowledge growth, and warfare. Recognising that all these results are multifactorial with multiplier effects and changing rates of evolution, Wilson's Natural Man is an important and compelling image. Wilson's precise scholarship and incisive argumentation will require a great deal of time for scholarly review and assessment.

Wilson's notions provide a convincing 'efficient cause' as to how man becomes a man – a useful complement to other images of man that are unifactorially defined in some substantive, structural or teleological form. Further, Wilson comes very much closer to Miller's ideal of a propositional science for human behaviour.[13] A number of pages bristle with mathematical equations and testable hypotheses. In my view, Wilson's Natural Man leads to the term 'hominization' – the making of man. This term is reminiscent of the scholarly work of two Roman Catholic priests, Karl Rahner and Pierre Teilhard de Chardin, in this field.[14]

From the Orthodox Christian viewpoint, man is conceived theogenetically as that singular link which joins the material order and the spiritual order of God's provident creation. This is so by virtue of the fact that by nature man's physical body inheres in the material order and that man's soul inheres in the spiritual order. There is no doubt that man is a sensate being, but he is also a psychical being of intellect and will. Each man is a

unity with the capacity or potential to learn and to act. Each is fallible in his knowledge and power. Each is unique in personality and integrity. Each is dignified to be a reflection of his Maker, though an imperfect or distorted image. Man is by essence open and truly human when he lives in God. By nature, man theologises.[15]

The crux of the Orthodox Christian question whether sociobiology is within the precincts of Orthodox Christian beliefs rests upon the nature of man as construed within sociobiology. Given the fact that Wilson's concept of the natural man does not depict him to be a deterministic robot of the blind forces of nature and that the freedom, dignity, intellect, and choice are operative within the human being, Wilson's sociobiological image of man is a useful complement to the Orthodox Christian patristic understanding of man, which was based upon the best science of those times.[16] It might be said that the single criterion of man's nature appears to be unifactorially unsound and perhaps an insufficient principle for making this judgement. In just reply, man is unifactorially defined within Orthodox Christianity as 'the image and likeness of God' imprinted in matter, wherein those aspects of human life that are entailed in natural law are necessitous and those aspects not so governed are for man to act upon in freedom and dignity with intellect and choice. For the Orthodox Christian, the Incarnation is the supreme adamic reflection – Christ being the second Adam.[17]

The criterial boundaries for the acceptance or rejection of sociobiology by Islam vary with the interpretive principles that have shifted with the historical role and perspective of Muslim scholars over time. The victory of Ash'arite theology over the Mu'tazilites' rationalism[18] and the late nineteenth century modernist debates of Sayyid Ahmad Khān[19] and Muhammed Qāsim Nānotawi[20] exemplify these shifting boundaries. Also one should note the twentieth century contributions of A.A.A. Fyzee,[21] Muhammed Iqbāl,[22] and Seyyed Hossein Nasr[23] in this regard.

If I correctly understand the Islamic epistemic problem with reference to sociobiology, there are two crucial points involved: (1) The scientific propositions of sociobiology can be construed as logical coherences of natural events as they present themselves to men, which coherences are accepted as the passive reflection of the absolute freedom of the Divine Act (Allah) – a freedom whose passive (or feminine) pole appears as the determined and bound matrix of cause and effect; (2) Sociobiology's natural image of man may not be interpreted in such a way as to deny nor contradict the human characteristics of free will, dignity and dependence upon Allah. From the above description of Wilson's Natural Man and the evidence of Revelation in the Qur'ān and Islamic thought, it appears that both of the crucial statements are within the purview of Islamic beliefs. Nasr's extrapolations of Islamic cosmological principles suggest the truth

of the first statement;[24] and a theological study of Adam's nature as revealed in the Qu'rān[25] suggests that Wilson's concept of man neither denies nor contradicts the Qu'rān.

Summarising the views of Islamic scientists participating in the 1981 IFIAS Knowledge and Values seminar in Stockholm, Ziauddin Sardar writes:

> Western scholars at the seminar were quick to notice that not all Western science and technology is outside this framework of Islamic values. For example, the ideas of appropriate technology, indigenous resource management and renewable energy resources all fall within the Islamic purview. Moreover, all scientific and technological activity pursued to promote *adl*, such as medical research to alleviate sickness and human misery, agricultural research and development to combat world hunger, environmental conservation and technology assessment for the prevention of *zalim* effects of technology, would automatically form part of Islamic science. But scientific and technological developments pursued with an *intent* [*sic*] to perpetuate bigotry, such as sociobiology, are certainly outside the framework of Islamic values. It is the intent which makes such science *haram*. The promotion of just and socially responsible aspects of Western science in the Muslim world can create a milieu for the flowering of Islamic science.[26]

The basis of this judgement on Sociobiology appears to rest upon the claimed ability of the Muslim scholar and the '*Ulamā*' to be able *to predict in advance of the results of research* whether a piece of science or technology will lead to '*adl*', (social justice). This position presumes to read human 'intent' from within some piece of yet-to-be-established part of knowledge, gleaned through God's creation. A reading of Wilson's work in sociobiology does not betray the intent to perpetuate bigotry, though there will always be some people who will use sociobiological propositions to justify their own bigotries. For a devout Muslim scientist, it is quite possible that his research findings in some field of science (wherein this scientist's contemplation of nature is his textbook for knowing Allah) is intended by him for *halal* (the praiseworthy) rather than *haram* (the blameworthy), though others can and do pervert his scientific findings into *haram*. A prior proscription of hypothetical fields of knowledge for research would be disastrous to the viability of Islamic science. It will be instructive to learn from Muslim scholars how human intent can be extrapolated or inferred from some proposition of theoretical science or technology before its achievement or accomplishment.

References

1 James Steve Counelis, *Weltanschauungen and Knowledge Systems: a Domain of Discourse*, mimeographed report for Seminar on Knowledge and Values of the IFIAS Program, 'Science and Technology in Islam and the West', the University of San Francisco/School of Education, 14 September, 1981.

2 James Steve Counelis, 'Relevance and the orthodox theological enterprise' a symbolic paradigm on Weltanschauung', *The Greek Orthodox Theological Review*, vol. XVIII, nos. 1–2 (Spring/Fall 1973), pp. 35–46. See also, James Steve Counelis, 'Information and the unity of general systems theory and cybernetics', *Kybernetes: an International Journal of Cybernetics and General Systems*, vol. VIII (1979), pp. 25–32; James Steve Counelis, 'Cross-Cultural Education and an Aristotelian Model of Weltanschauung', in Raymond V. Padilla (ed.), *Ethnoperspectives in Bilingual Education Research: Theory in Bilingual Education*, Eastern Michigan University/Department of Foreign Languages and Bilingual Studies, Ypsilanti, 1980, pp. 250–60. Cf. Donald R. Burrill (ed.), *The Cosmological Arguments: a Spectrum of Opinion*, Anchor Books/Doubleday and Company, Garden City, N.Y., 1967; Stephen C. Pepper, *World Hypotheses: a Study in Evidence*, The University of California Press, Berkeley, 1942.

3 Cf, Mortimer J. Adler, 'In Defense of the Philosophy of Education,' in Nelson B. Henry (ed.), *Philosophies of Education: Forty-first Yearbook of the National Society for the Study of Education*, University of Chicago Press, 1942, Ch V.

4 James Steve Counelis, 'What is an Interdisciplinary Course in the Social Sciences?', *Community College Social Science Quarterly*, vol. III (Winter 1973), pp. 29–31, 36.

5 James Steve Counelis, 'Education about education', *Educational Studies*, vol. IX (Winter 1979), pp. 407–24.

6 Ian G. Barbour, *Issues in Science and Religion*, Prentice-Hall Inc., Englewood Cliffs, N.J., 1966.

7 Seyyed H. Nasr, *An Introduction to Islamic Cosmological Doctrines: Conceptions of Nature and Methods Used for Its Study by the Ikhwān al-Safā', and al-Bīrūnī, and ibn Sīnā*, reprinted; Shambala Publications, Inc., Boulder, 1964, 1978. For a very recent Islamic effort in this area, see Ziauddin Sardar, 'Why Islam needs Islamic science', *New Scientist* (April 1982), pp. 25–8.

8 The following are epistemic studies in relation to the Greek Orthodox Church: James Steve Counelis, 'Orthodox Christian higher education', *The Christian Scholar*, vol. XLVI, no. 2 (Summer 1963), pp. 145–54; James Steve Counelis, 'Patristic man, science's man and education,' *Greek Orthodox Theological Review*, vol. XII, no. 1 (Summer 1966), pp. 84–91; James Steve Counelis, 'The American Christian University: a position paper', *Christian Scholar's Review*, vol. II, no. 3 (1972), pp. 236–41; James Steve Counelis, 'Contemporary epistemology, formative theology, and the forthcoming great and holy council', *Greek Orthodox Theological Review*, vol. XXVI, nos. (Summer/Fall 1979), pp. 248–55; James Steve Counelis, 'Hominization and Pentecost', (In press).

9 Edward O. Wilson, *Sociobiology: A New Synthesis*, The Belknap Press/Harvard University Press, Cambridge, Mass., 1975; Edward O. Wilson, *On Human Nature*, Harvard University Press, Cambridge, Mass., 1978.

10 Wilson, *Sociobiology*, pp. 5–6.
11 Arthur L. Caplan (ed.), *The Sociobiology Debate: Readings on Ethical and Scientific Issues*, Harper and Row, New York, 1978, *passim*.
12 Bernard Berelson and Gary A. Steiner, *Human Behavior: an Inventory of Scientific Findings*, Harcourt, Brace and World, Inc., New York, 1964, pp. 664–5; and Counelis, 'Patristic Man,' pp. 87–9.
13 James G. Miller, 'Toward a general theory for the behavioural sciences', in Leonard D. White (ed.), *The State of the Social Sciences*, The University of Chicago Press, 1956, pp. 29–65.
14 See: Karl Rahner, *Hominisation: the Evolutionary Origin of Man as a Theological Problem*, Herder and Herder, New York, 1965; Pierre Teilhard de Chardin, *The Appearance of Man*, Collins, London, 1956, 1965; Pierre Teilhard de Chardin, *Man's Place in Nature: the Zoölogical Group*, Harper and Row, New York, 1956, 1966; Pierre Teilhard de Chardin, *The Phenomenon of Man*, Harper and Row, New York, 1955, 1959. For an Orthodox Christian scientist's view, see: Theodosius Dobzhansky, 'Evolution: implications for religion,' in Kyle Haselden and Philip Hefner (eds.), *Changing Man: the Threat and the Promise*, Anchor/Doubleday Books, New York, 1969, pp. 142–55.
15 For an extensive set of patristic sources on the Orthodox Christian image of man see' Counelis, 'Orthodox Christian Higher Education', *op. cit.*; Vladimir Lossky, *In the Image and Likeness of God*, St Vladimir's Seminary Press, Crestwood, N.Y., 1974, chs. 5–7; George A. Maloney, *Man: The Divine Icon*, Dove Publications, Pecos, 1973; John S. Romanides, 'Man and His True Life according to the Greek Service Book', *The Greek Orthodox Theological Review*, vol. I, no. 1 (August 1954), pp. 63–83; D.S. Wallace-Hadrill, *The Greek Patristic View of Nature*, Barnes and Noble, Inc., New York, 1968, chs. 2–3; Zachary C. Xintaras, 'Man, the Image of God according to the Greek Fathers', *Greek Orthodox Theological Review*, vol. I, no. 1 (August 1954), pp. 48–62.
16 Wallace-Hadrill, *op. cit.*, ch. 2.
17 Mark 1: 13; Rom. 5: 12–21; I Cor. 15: 21–22, 45–7.
18 Von Grunebaum, *op. cit.*, *passim*.
19 Sayyid Ahmad Khān, 'Principles of Exegesis', in Aziz Ahmad and G.E. von Grunebaum (eds.) *Muslim Self-Statement in India and Pakistan, 1857–1968*, University of California, Los Angeles/Otto Harrossowitz, Wiesbaden, 1970, pp. 25–42.
20 Muhammed Qāsim Nānotawī, 'Assessment of Religious Beliefs', in Ahmad and von Grunebaum, (eds.), *op. cit.*, pp. 60–76.
21 A.A.A. Fyzee, 'Specific Rules of Interpretation', in Ahmad and von Grunebaum, (eds.), *op. cit.*, pp. 198–203. See specifically p. 201 for section entitled 'Reinterpretation of cosmology and scientific facts'. Cf. Fazlur Rahman, *Major Themes of the Qur'ān*, Bibliotheca Islamica, Minneapolis, 1980, ch. 4.
22 Mohammad Iqbāl, *The Reconstruction of Religious Thought in Islam*, Oxford University Press, London, 1934.
23 Seyyed Hossein Nasr's extensive publications are well known. In the eyes of this writer, his historical and philosophical scholarship on medieval cosmological notions is his best effort; and his recent summary volume on knowledge

and the sacred is of interest: Seyyed Hossein Nasr, *Knowledge and the Sacred*, Crossroad, New York, 1981.

24 Nasr, *Islamic Cosmological Doctrines*, pp. 1–22, 275–81.

25 The classic Qur'ānic citation is: *Qur'ān* 2: 255.

26 Sardar, *op. cit.*, p. 28.

12 Islam and the West: synthesis or 'con-fusion'?

S. PARVEZ MANZOOR

The conceptual framework for discussing Islamic and Western approach to science and technology, as used throughout this book, gives rise to a number of theoretical questions, and hence calls for a few explanatory remarks. As envisaged here, Islam and the West denote, in a superficial and theoretical manner, two civilisation units.[1] The terminological connotations, however, are disparate: Islam is construed as an ideological civilisation possessing teleological orientations, whereas the West is imputed to lack, ostensibly at least, any commitment to ultimate goals.[2] The antipodal mode of apprehension further posits – inconsistently – that these two civilisational units can be contrasted, logically if not empirically, against each other and that the West too, despite the implicit innocuousness of its geographic terminology, stands for an ideology, a particular way of life, a concrete historical experience and a set of specific institutions. Unless redeemed by concrete historical analysis, this system of thought would reduce Islam and the West to two of the most monstrous, from the reciprocal point of view, abstractions.

No doubt, to view 'Islam' and 'the West' as two opposing and implacable adversaries locked in deadly combat is intellectually absurd, historically inaccurate and politically ominous,[3] but it would be naive to view this dialogue, even if it is avowedly a quest for theoretical synthesis, as a mere intellectual claptrap. The whole exercise, notwithstanding its academic conception as an intellectual problem, is, in fact, symptomatic of far greater issues. Essentially, the search for synthesis signifies the need for an intellectual and ideological détente between the 'Islamic' and the 'Western' worlds. More specifically, the Muslim goal in achieving this synthesis is nothing less than the appropriation of modern – historically and ideologically Occidental – civilisation without forfeiting its unique cultural identity. From a still narrower perspective, Muslim participation in the dialogue may seem to entail a further deliberation of the question that is the main moral and intellectual issue of the contemporary Muslim world: how is the specifically Western institution of science and technology reconcilable with the moral and cultural values of Islam and how, if at all, is it to be adopted? And concomitantly, if it is to be rejected altogether, what are the Islamic options available for the reconstruction of an alternative, indigenous model?

From the Western vantage-point the quest for synthesis could be construed as the next logical step in the ongoing process of the universalization of

the Western civilisation itself. Having absorbed and subdued its own religious heritage of Judaeo-Christianity to the – seemingly – superior and more practicable principles of secular meliorism, the West feels confident that a truly universal civilisation, bereft of all confessional partisanship, is feasible. Islam, being the closest of kin in terms of religious, historical and ideological affinity, represents to the West the outsider most likely to respond sympathetically to its wooings.

The problem of synthesis is not a recent one: it betrays mankind's eternal tension between aspired universalism and actual particularism. Synthesis is also in the Hegelian scheme a conciliation of two antitheses. And this is how both the civilisations of Islam and the West have perceived each other in history: as two real and irreconcilable antitheses. To medieval Christiandom Islam presented itself as an acute 'problem'. First and foremost, it was a problem of Christian theodicy: what purpose did a new 'revelation' serve when God Himself had already appeared on this earth? How does the advent of the new Arabian prophet, long after the age of prophecy had culminated in the crucifixion and resurrection of God's Son, fit into the divine scheme of salvation? These were – and still are – the main theological issues Christianity was – and still is – forced to take into consideration in its relationship with Islam. Practically too, Islam was a problem that no Christian could ignore: the great might of its empire and its armies made this painfully manifest. Ideologically, too, Islam posed itself as a problem: its sway over the minds of countless people, even its facile success in converting millions of Christians, was a matter incomprehensible to medieval Christianity. How, if at all, the 'problem' of Islam was 'solved' in actual history is beyond the scope of this essay, but the present tension testifies that the 'problem' still awaits a successful response, let alone any 'solution'.[4]

What is equally noteworthy – and much less debated – is that the modern, post-Renaissance West too poses itself as a problem of equal vigour to contemporary Islam. It is a 'problem' which is experienced, in a similar way, as religious, practical and ideological. As a religious problem, the secular, Faustian West represents the ultimate threat to *homo religiosus*: that of the human vicegerent usurping the true sovereign. This, one can easily perceive, is tantamount to negating the very *raison d'être* of *homo islamicus* who, as the religious man *par excellence*, finds the secular West particularly menacing.[5]

Essentially, however, the West is a practical problem for Islam: a problem not only of political and military might but that of institutional and intellectual superiority as well. It is a problem that could, literally speaking, threaten the very existence of the Muslim world – or its 'Islamicness'. – The search for synthesis for Muslims is thus not an intellectual luxury but a matter of survival.

An ineluctable corollary of the disparate terminology referred to above is that the West, not least because of its self-avowal, is regarded an empirical reality – full of human achievements and failures, but existing, nonetheless, *hic et nunc*. Contrariwise, Islam stands for transcendent ideals that are not subject to historical arbitration.[6] Consequently, our treatment of the topic in this book has been almost totally *theoretical*, recognising no *empirical* limitations. Doubtless, the approach is beset with serious epistemological limitations and many valid intellectual objections can be raised against our adopted stance. Nevertheless, it is justified on the grounds that the subject matter discussed in these pages is amenable only to this kind of treatment. Furthermore, the whole ideological framework of Islam needs to be presented to the West in a fresher intellectual expression. As it is, there is a perceptible discrepancy of concepts and terms employed to express Islam vis-à-vis the West.[7] A common idiom that could do some justice to the intellectual traditions of both the civilisations is sadly lacking and the one employed here is but a poor compromise. Any facile amalgamation of the two traditions will not lead to synthesis but to 'con-fusion' as James S. Counelis' paper too clearly shows. Despite its impressive array of theological concepts, cybernetical logic and mathematical formulae, it is a futile exercise in spurious methodology. Behind the smokescreen of cumbersome syntax, pompous phraseology and endless, unnecessary detail, there lurks a monstrous conception of man and a covert plea for genetic manipulation. This Muslim finds such thinking extremely dangerous and, if adopted, auguring catastrophic consequences for the Muslim intellectual tradition. Were it not for these practical implications, it would have been better to have left it to speak for itself: it itself best reveals the tragic limitations of linear reasoning.[8] But as Counelis' essay, if not his argument, deserves a Muslim review because of the wider (implied or not) ramifications of the underlying moral and political philosophy, a few brief comments here would not be inappropriate.

Counelis' paper is interesting on two counts: one, because of the epistemological confusion of his cybernetical approach; two, because of his unreserved sanctioning of *Sociobiology*, betraying no compunction against its questionable ethical intent. Both these points need further elaboration.

Central to Counelis' model is the now widely accepted notion of 'worldview' and its arbitrary fourfold division into the categories of Cosmology, Ethos, Dynamics and Telos. If we disregard the tedious elaboration of detail and exemplification (in Islamic cases based on superficial observation) and a few logical inconsistencies,[9] the model itself need not be questioned rigorously: it is after all a hypothetical creation and not an empirical reality and Counselis certainly has the right to propound any theoretical scheme that furthers his 'telos'.

The difficulties arise, however, when Counelis launches his concept of *Discipline* and tries to establish its relationship with *Worldview*. Though correctly perceiving Disciplines to be hierarchically subordinated to Worldviews, he then, nebulously and inconsistently, bestows an autonomous status to Disciplines and proposes an intra-worldview debate through the arbitration of these supposedly independent Disciplines! The logic, or lack of it, is flabbergasting. No worldview submits itself to the judgement of any discipline that has arisen out of its own ground, and least of all is it susceptible to the claims of unindigenous disciplines. Marxism would not dream of having its 'truth' tested by the canons of Buddhist logic; Christianity would not apply the techniques of psychoanalysis to the personality of its Saviour, and Islam finds Occidental attempts at the exegesis of the Qur'ān by historicist epistemology extremely odious. It is hardly likely that Counelis is unaware of these elementary logical rules: no, he seems to have fallen into the usual trap of the 'objectivity of certain scientific disciplines'. Why would he otherwise regard, for instance, Gamow's 'big bang' theory as 'challenge to theistic religions such as Islam and Christianity'? By what empirical norms is Gamow's cosmogony more credible than the traditional ones of Islam and Christianity? Is one to assume that Counelis believes that cosmogonies are bereft of ideological content and independent of any telelogical intent? If the 'big bang' cosmogony of Gamow does not signify the worldview of nihilism and scepticism for Counelis, then he may justifiably be accused of being a total stranger in the thorny terrain of epistemology. In fact, he either seemed to have totally missed, or not comprehended at all, the most elementary issues of the current 'Science, values and worldview' controversy.[10]

It is a basic tenet of the psychology of perception that hypotheses precede observations, that to 'perceive' something is to impose 'preconceived' mental order upon it. Likewise, the history of science teaches us that scientific 'revolutions' occur not because of observed facts but because of changed paradigms. Disciplines, to use the very categories propounded by Counelis, are born within the matrix of particular worldviews, are forever value-laden and can never pass judgement on the values themselves. Intents are prior to actions and there are no facts without values; facts are 'taken' not 'given'; 'made' not 'observed' as even the etymology itself implies. The most essential component of a worldview is its teleology: it is an axiological claim about how things *ought to* be rather than about how they *are*.

No amount of empirical data, therefore, can force a worldview to surrender its ultimate claim. No historical study can, for instance, convince Marxism that its assertion of the 'inevitability of the dictatorship of the proletariat' has become invalidated by the available evidence, because

this statement belongs to its teleological worldview and no historical discipline dare challenge it. No amount of additional 'knowledge' about the universe, likewise, can convince a Muslim or a Christian that Final Judgement will not take place, because in their worldview it ought to, it must. To claim immunity of certain scientific disciplines of astronomy and 'contemporary extrapolations of Darwinian evolution' from the moral judgement of one's worldview is to betray a failure of nerve, a loss of faith itself.

The epistemological confusion in Counelis' argument is, thus, ultimately due to the moral timidity of its author. Nothing, however, betrays this moral timidity, nay callousness, more than the writer's unreflecting acceptance of the ethically debatable doctrines of sociobiology.[11] That the pseudo-discipline of sociobiology has come under heavy attack from egalitarian philosophers and that some of the Islamic objections to this and the related fields of gene-manipulation and reproductive biology have been ably discussed in an earlier paper[12] does not oblige us to have a close look at sociobiology itself; our concern will be with Counelis' perception and whole-hearted espousal of the sociobiological concept of 'the natural man'. In fact, he is bold enough to claim that 'Wilson's concept of the natural man is a useful complement to the Orthodox Christian patristic understanding of man'. Not content with that, he even ventures to opine that 'Wilson's concept of man does not deny nor contradict the *Qur'ān*'.

Nothing illustrates better the difference of mental outlook and intellectual tradition between Islam and the West (for I contend that Counelis, despite his strongly self-conscious affiliations with Orthodox Christianity, is a *Western* thinker in the post-Christian sense) than the present context. Counelis' reasoning is so abstract, pre-occupied with pure disciplines, bereft of situational and contextual concreteness and so little concerned with ethics that a more 'un-Islamic' model is hard to conceive. Anyhow, it would be impossible to find in the totality of Islamic intellectual tradition (excepting a few of the modern, Westernised thinkers) anyone who appraises innovative thought in a similar manner, i.e. without making a single enquiry as to the *intent* of the proponent or the social relevance of his product! Indeed, in a truly Islamic milieu thinkers like Wilson propounding hypothetical theories of the nature of man 'as a useful complement to the *Qur'ānic* understanding of man' would be unthinkable. It is thus appropriate to recapitulate that *Sharī'a* methodology, which is the *Islamic* way of *Islamicising* history, neither operates on hypothetical models nor is oblivious of the life-situation in which a system of thought occurs. *Sharī'a* is, as we stated earlier, not a soteriological ontology but moral existentialism: it concerns itself not with concepts but with deeds.

The foregoing does, in my opinion, convey something of an answer to

Counelis' perplexity as to the ability of the Muslim *'Ulamā'* to extrapolate human intent 'from some proposition of theoretical science or technology *prior* to its achievement or accomplishment'. That Muslims are concerned with the *intent*, he need not doubt – the whole Muslim intellectual history substantiates it. That *intent* is known – or knowable – in 'the proposition of theoretical science and technology' is simply due to the worldview inherent in the particular science and technology. In a scientific enquiry, as in ordinary perception, theory precedes practice, values precede facts and intent comes before action. To deny this is an act of bigotry; to be ignorant of this in an 'intra-worldview' dialogue is a sign of inexcusable intellectual sloth. Conceding now that the *intent* of a theoretical proposition is knowable in advance, how is it *actually* made known? The Islamic answer is quite simple: by never divorcing thought from its existential matrix and forever tying hypothetical thought to the rigorously practical framework of the *Sharī'a*. Would Counelis, one may frankly ask, rather wait upon a nuclear scientist perfecting his own device of the neutron bomb to finish off his experimentation before ascertaining his intent? Or would he, as the hypothetical warden of Auschwitz, defer moral judgement on his staff of doctors experimenting upon live human bodies till after 'their achievement or accomplishment'?

With these sobering thoughts, I would like to end on a note of warning. The essay in question displays with stark candour all the traits of dominant Western thought. It is rabidly technical, abstract, systematic and reductionist. It pretends to be logical, but in fact ends up by becoming mono-linear and uni-dimensional. It is not ethical, nor is it unethical: ethics simply follow its inexorable logic. It perpetuates itself and generates questions for which it already has pre-fabricated answers. Ostensibly it lacks any cultural orientations, but inwardly it conspires for the domination of 'scientific' culture. Unfortunately, this type of thinking is too readily available to the Muslim world in the form of 'expert advice' and, in fact, is playing havoc with our tradition. So far the search for the fusion of Muslim and Western thought has not produced synthesis but 'confusion'. Nevertheless the search must go on.

References

1 To view human history in terms of *civilisations* is tantamount to the tacit acceptance of Arnold Toynbee, or of his less erudite but more perceptive mentor Oswald Spengler's analytical model. Marxists would of course question such an assumption as their own theory posits *means of production* and *class* as the essential units of universal history. The adoption of the present model is also – unfortunately – a concession to 'the pendulum theory of history'; i.e. one which construes historical processes in terms of the inevitable 'struggle' between 'East and 'West'. C.f., for instance, N. Parkinson, *East and West*, London, 1965.

2 Islam may be defined, without any further qualifications, as a commitment to submit oneself to the will of God: it is thus always teleological. Since the time of the Renaissance, by gradually, albeit unconsciously, renouncing Christianity as the sole arbiter of truth, the West does not seem to have espoused explicitly any collective ultimate goals. The search for ultimate goals has become an *individual* rather than a *civilisational* issue. Still, one may discern the implicit goal of Western civilisation – discounting historical realities – as 'the pursuit of happiness and well-being of the greatest number of people for the longest period of time'. Remarkable, however, is the West's confidence in itself that it feels no need to define its ultimate destiny in terms of non-materialistic – non-transcendentalist – terms. The transcendent, it appears to the West, can be found only in *man*. This postulation is equally true of Christianity and of Marxism: the former discovers the transcendent in the unique person of a human saviour, the latter in the salvific collectivity of human masses in history. The unique expression of this immanence is the Western method of applying rationalism to 'man, nature and history'. For other cultures, the experience so far has been an unwilling accommodation of Western ideology and an ever-greater encroachment on indigenous traditions by Western technology.

3 The method of viewing Islamic civilisation in terms of the 'other' of the West, associated with the worldview of Orientalism, is, as Edward Said has recently asserted with great poignancy and intellectual acumen, morally dubious, politically jingoistic and epistemologically fraudulent. See his *Orientalism*, New York, 1978 and *Covering Islam*, New York, 1981.

What is less commonly debated is the fact that many Muslim writers too have regarded the West as a barbarous entity, bereft of every empirical reality and lacking those moral and spiritual values that are construed to be the core of Muslim civilisation.

4 There are two excellent studies of Christian perception of Islam as a 'problem'. See, for instance: Norman Daniel: *Islam and the West: The making of an image*, Edinburgh 1960 and Terry Southern: *Western Views of Islam in the Middle Ages*, Cambridge, Mass. 1962. For the philosophers of universal history, Islam continues to be a theoretical and intellectual 'problem'. See Albert Hourani, 'Islam and the Philosophers of History', in a recent reprint of his earlier essays *Europe and the Middle East*, London, 1980, pp. 19–73.

5 Very few Muslims have approached the 'problem' of the West in a spirit of – relatively – detached enquiry. Those who have addressed themselves to the issue, have, in fact, done so either as preachers or as polemicists. Christianity does not present itself as the very antithesis of Islam in the manner the secular West does. Despite the theological differences with Christianity, some of which are of fundamental import and irreconcilable, Islam considers Christianity a sister-religion with which a *modus vivendi* is not impossible to achieve. Perhaps this posture of smug tolerance betokens Islam's firm conviction that it is not very susceptible to Christian *religious* appeal. Even in the recent episode of colonial supremacy of the West, a modern writer observes, Islam could successfully thwart the religious onslaught of Christian missionaries, but to the challenge of the West, it has still not found any adequate response. Cf. G.H. Jansen; *Militant Islam*, London, 1979, pp. 49–120.

6 Unlike 'Christianity', 'Buddhism', 'Hinduism' etc all of which seem to be designations of the collectivity of Christians, Buddhists and Hindus respec-

tively, 'Islam', the word and the concept, is not derivative of the Muslim: it is in fact the other way around. Thus a Muslim writer may justifiably claim: 'Islam, being a normative realm of value, is dissociable from any reality that is identified with it. Islam is not the Muslim's social system, nor the Muslim's theological, aesthetic or other system, but that which all these strive to realise ... Any criticism, therefore, directed to the reality cannot ever discredit Islam'. Isma'īl R. Al-Fārūqī; *on 'Urūbah and Religion*, Amsterdam, 1962, p. 125.

7 *E.A. Burtt* has shown that the categories in terms of which the natural world is made known to the modern man are those of time, space, mass, energy and the like. For the medieval culture, the world was apprehended in terms of substance, essence, matter, form, quality, quantity, etc. See his *The Metaphysical Foundations of Modern Science*, revised edition, Doubleday Books, New York, 1954, p. 18. Something of this terminological and conceptual discrepancy exists when discussing Islam and the West together.

8 C.f. T. Rozsak, *Where the Wasteland End*, Doubleday, New York, 1972, pp 202–52, for a scathing criticism of reductionist epistemology.

9 Counelis, for instance, defines Cosmology as 'the objective observation people make about their world and the pattern of meaning they impose upon them'. The author is not clear about the relationship of meaning and observation. The so-called objective facts are sought with respect to the worldview one holds. This point is elaborated in the text later.

10 See for example: J.R. Ravetz, *Scientific Knowledge and Its Social Problems*, Oxford University Press, 1971; H. Rose and S. Rose (eds.), *Ideology of/in the Natural Sciences* (2 vols: *The Radicalisation of Science* and *The Political Economy of Science*), Macmillan, London, 1976; David Morley, *The Sensitive Scientist*, SCM Press, London, 1978; Richard Whitley (ed.), *Social Processes of Scientific Development*, Routledge and Kegan Paul, London, 1974; and I. Lakatos and A. Musgrove, *Criticism and the Growth of Knowledge*, Cambridge University Press, 1970.

11 Cf.: Philip Green, *The Pursuit of Inequality*, Pantheon, New York, 1981, pp. 15–42 and John Green, *Science, Ideology and World-view*, University of California Press, 1981, pp. 84–7 and 194–6. Greene (p. 187) writes: 'Paradox can go no further. The familiar paradoxes of Christianity – man's God-created but fallen nature, human freedom and divine foreknowledge, the mystery of the Trinity – are as nothing compared to the mysteries of Wilson's evolutionary epic: its ordered universe without an Orderer, its progress from blind force to conscious intellect and will without any immanent purpose and direction, its heroic epiphenomenal human mind produced by evolutionary chance but capable of comprehending the forces that produced it and using them for good or ill, its morally responsible beings in an amoral universe, its faith in the power of science to provide ethical and spiritual as well as practical guidance for mankind, its naive confidence in the ultimate beneficence of sheer intellect, its fearful ignorance of human perversity, its fearful insensitivity to the tragic dimension of human life.' Does Counelis really believe, that this creature is a supplement to the Orthodox Christian man?

12 C.f., for instance, Munawar Ahmad Anees' chapter on Reproductive Biology, pp. 91–120.

13 Science in Islam and the West: synthesis by Dialogue

ROBERT WALGATE

Is science an aspect of beauty and truth? Or of power and domination? It has become both, both described by the same abused word, 'science'. The disentanglement of the two aspects of science is crucial for many reasons – but principally because both truth and power are important, and it is necessary to see each clearly for what it is.

This central question seems to come into sharp focus when we make an unusual juxtaposition: between Islam and the West. (Perhaps history has something to do with it: the Greek philosophers were transmitted through Islam, and transformed and added to; and Islam is itself closely related to the Judaeo-Christian tradition in which science ultimately flourished.)

Here, then, we have a practical objective: to compare Western and Islamic concepts of the nature of science and technology, to see if any common view might emerge to the benefit of both. Initially, perceptions on the 'two sides' (to use the term merely for convenience) appear very different, but there is a middle way. A unique seminar held in September 1981 approached it – not that the individuals from East and West who were privileged to be present reached a consensus, but they certainly began to feel a sense of rapprochement: the views of each side illuminated those of the other. Here we shall use the seminar as a guide to that process of enlightment.

First, what of the 'crisis of science' in the West? The immediate fact is that certain technical developments – led by nuclear power and polluting technologies – have created considerable public alarm and opposition. The criticism is sometimes environmental, sometimes ethical, sometimes political; but whatever form it takes, it questions the 'experts', and in particular scientists and technologists – a tremendous swing from their glorification in the 1940s and 1950s.

For political reasons – there are votes in it! – this questioning has been institutionalised in the form of 'inquiries' or 'impact statements' to be delivered to 'Ministries of the Environment' or other such structures. However, these structures are not merely awkward obstacles to development: they are now widely and rightly seen in the West as necessary to the proper democratic development of technology. There are two fundamental discoveries behind these moves: that an expert (even a pure scientist) can be wrong, and that an expert can be biassed. Each feeds off the other, but they lead to a very important consequence: since the expert usually depends on some employer for his or her career or income, and

since that employer is often not disinterested in the technology in question, the 'expert' advice will take on the colour of the employer's interests. Thus to any piece of expert advice must be appended the question 'who pays that man (or woman)?'

Even scientists (as opposed to technologists) can be affected by this blight. There have always been temporary factional interests *within* the purest science: consider the battles over whether the Earth moved, or over the spontaneous generation of life, or over the validity of quantum mechanics – where Einstein clashed with Bohr. These are matters where the science of the day was insufficient to resolve a question, and there are always such matters: in fact, one could say that *all* of scientific activity at any one time was involved with such questions: they are the essence of scientific work. Scientific 'judgement' usually amounts to taking one line or another on such matters, and following that line as a research programme. All sorts of extraneous factors can determine the line any scientist takes, from personality to politics, religion or philosophy. Thus even in the most basic science, a scientist may be biassed; even if, in the end, 'science' (as an activity) really does lead to 'Science' (as agreed, tested and incontrovertible fact). There is a tremendous difference, for example, between asking a scientist which is bigger, the Moon or the Earth, and asking him how either body was formed. The former question has an answer in 'Science' (as knowledge), but the latter must be answered from within an existing research programme – i.e. from 'science' (as activity).

There is also a deeper matter: that even 'Science' is an approximation, in the sense that Newton's laws of motion are only an approximation to general relativity, which is in turn only an approximation to some other theory, and so on. However, this is a philosophical point, generally of little practical relevance – so long as the requirements of any engineering which uses the science are less exacting than the science itself. This is often the case, but not always so. Sometimes technology itself drags science forward; here, however, the situation is best described in terms of an active research programme – i.e. of 'science' rather than 'Science'. Ultimately, the boundary line is a matter of definition and argument.

These matters would be academic if science had no impact on life; but it does, in many ways, too many to enumerate here. One of them is through technology, which is the embodiment both of a will to do something (irrigate a field, perhaps) and of a science (here, hydrology). Thus with technology, there is a new level of questioning, to be added to the questioning of the expert: whose will is involved in this technology? Who exactly profits from it? Moreover, since many 'basic' scientists are these days supported either by government or industry – or some other body to which 'truth' is not the principal objective – research programmes are themselves frequently selected not according to the internal interests of

science, but according to the interests of the paymasters. Even if it were granted that all scientific knowledge, even concerning interim, frontier questions, was exact, the *gaps* in that knowledge are determined by outside interests. Thus there is now a vast reservoir of knowledge about temperate soils, but little about tropical ones – although the latter are of at least equal intrinsic interest. Solid state physics has progressed immensely since the war – at least in part because of the search for new materials by the electronics industry.

But it is difficult to graft these ideas into Islam. Islam is a revealed faith, with its holy texts, and the Islamic state relies on the authority and respect for learning. Moreover, science, as an aspect of the truth, is a facet of Allah, and is beyond criticism. It is in fact a religious duty to investigate God's creation. To a true scientist this is a delightful idea, refreshing to one who might recognise the strength of the criticism's outlined above, but still feel that there is a beauty, a perfection which can be discovered in Nature.

On the face of it there could be no resolution between two points of view, one critical, one reverential. But there is a way, as the Stockholm seminar demonstrated. It reached – as one of those present, Ralph Braibanti, put it on the last day – 'the threshold of something tremendously significant': a system of values within Islam with which to understand the 'crisis of science' in the west and to shape science and technology policies which reflect the cultural and religious imperatives of Islam.

The Seminar

The three-day seminar described here was the first of a series of six, in which Western analysts and critics of certain disciplines of importance to development – science, technology, medicine, agriculture, environment and industry – are introduced to corresponding experts from the Muslim world.

This account of the seminar is not so much an attempt to produce a record of the event, but more an analytical exercise to show how enlightenment, and indeed certain amount of synthesis, was reached at the seminar. It is my belief that open dialogue, rather than formalistic, logical frameworks, is the best tool for achieving synthesis between two different approaches to science and technology. The Stockholm seminar demonstrated the power of this method.

First, the dialectical opponents. On the one hand, there is a refreshingly simple belief that science is a fundamental good, and that the individual piety of a scientist, within a notional Islamic state, can deal with all the problems that might face science in society. On the other, there is the secular and critical view: that science is a social activity which, just like others, responds to and is created by social and political forces – deter-

mined by interest groups within society and within science – and that it can only be controlled through political (and hence institutional) mechanisms.

Second, to extend these initial Muslim and Western positions, those of the first view at the seminar were generally of opinion that the Western scientific 'crisis' was also a spiritual crisis; and therefore that the very terms in which the crisis was described by the Western secularists were inappropriate. Correspondingly, the secularists could not countenance a religious interpretation. This apparent confrontation was made even more interesting by the presence of Christian fundamentalist views (in the form of Eastern Orthodoxy) and a degree of mysticism on the Western side, and of a measure of pragmatic views among certain Muslims present.

Z. Rahgib El-Naggar, expert on Arabian geology and chairman on the first day, put the Muslim absolutist view. There are two facets of knowledge in Islam: revealed knowledge and acquired knowledge (pure and applied science). Both are to be revered, as aspects of truth. The loss of a living bridge between these revealed and acquired forms of knowledge was the root of the crisis in the West, argued El-Naggar. Science in the West has become a tool of power; unless controlled by ethics, it can be destructive.

Jerry Ravetz, Western science historian and mystic, put the Western critical view. Science is value-laden, he argued, but those values are concealed. We think of science as dealing with facts, said Ravetz. These are objective, hard, 'out there' and real. Values, on the other hand, are subjective, soft, 'in here', and elusive. But what is to be made of the evil effects of science for which no-one will take responsibility? And what of the fact that science itself is filled with dogma and superstitition? Science enters the world of values because we need it for our economies. Facts and values must be synthesised; and yet a Western student of science is never exposed to problems which deal with soft values. Yet teaching, in being selective, uses considerations of value.

There is another paradox, said Ravetz: scientists argue strongly that science has the greatest *value*, although it itself is value-free.

Values become apparent in science during decision-making, according to Ravetz. Then, it appears that even discovered 'facts' are not entirely objective. For example, in statistics, confidence limits are shaped by values. The rejection of an 'aberrant' reading can also be determined by values.

Ravetz could then have moved towards the neo-Marxist position – that scientific knowledge is entirely a socio-political artefact. But he drew back from that and adopted an elegant compromise. 'Although it is difficult to argue that our positive knowledge is socially constructed,' he said '*we can say that our ignorance is socially constructed.*'

As for technology, Ravetz argued that there were two common delusions: that a 'market' exists which can determine what *should* happen; and the idea that everything possible is obligatory (the 'technological imperative'). The intermediate and appropriate technology movements had removed these delusions, by emphasising that all technologies have an end in view. Someone is choosing that end, and the means to reach it. The real question in technology is: who chooses, and by what values?

Ravetz then considered the historical origin of the predominant, technocratic, Western worldview – and introduced a mystic tone which resonated with El Naggar's Islamic perspective. In medieval times, two streams were combined, said Ravetz. First, the disciplined study of the classical literature and particularly of the Aristotelean 'organic' picture of nature; and second, a 'magical' tradition, directed towards the manipulation of an 'enchanted' world. In seventeenth-century Europe, these were displaced by the 'corpuscular' view: nature was dead, dehumanised, disenchanted and magical power was displaced by scientific power. The concept was of social possession over a dead nature: a secularised ideology. 'This material civilisation is destructive of cultures,' concluded Ravetz.

Helga Novotny then set out to argue that science had no intrinsic 'worldview', but that it had been adopted by various social groups as if it did have such a view. Science was dehumanising, and had to be supplemented by the notion of an active, cognitive self, she argued.

She described the public image of science as a defence created by scientists. This image is full of myths and delusions, which amounted to 'a skilful method of insulating science from attack'. This was the heroic image, the image of the Enlightenment. But heroism cannot admit defeat. The image also obscures the social base of science.

But there are other images: the corrupt image (science as a mere tool); the apocalyptic image (science 'at the brink', for example through nuclear weapons); and the tarnished image (emphasising the capitalisation of science and technology). The heroic image is declining and the tarnished image rising; but to attack the images is to ignore the reality.

Novotny identified three strands of historical criticism of science which 'reflect the movements of social groups'. The humanists – 'mystics, poets and prophets' – thrown up in reaction to early industrial society, warned that science gave no guide to how men should live their lives. But 'science cannot offer symbolic meanings; it does not offer a worldview'.

Then 'practically every political movement' of the 1920s and 1930s adopted science as a rallying cry.[1] Science was interpreted as offering a worldview, that 'it serves life and life absorbs it'.

We have now come to see that science cannot be separated from its applications; and that *technological artefacts embody a certain political*

order. The three steps had been: that science was amoral and value free (humanists); that it incorporated all values (the inter-war view); to now, the questioning of which values, whose values, science and technology incorporate.

Nowadays, outsiders are not afraid to approach science: developing countries; women; lay movements, all claiming that there are suppressed forms of knowledge. But without changing the rules of the game, there is no admission, said Novotny. 'The yearning for an alternative science is out of all proportion to the possibility of realising it.' Even worse, the creative space available to scientists who wish to take science in a different direction – for example in molecular biology – is actually narrowing.

So there is no escape; we must ask how science has changed us and how to react. Science began with trial and error, but now it is too costly to cover all options. Science measures; and when things are measured, they can be standardised, and used for setting social norms, 'cutting and screening' in health, housing, education and so on. Science 'has the generation of insecurity built-in'. It eliminates the human, even in social science. The only effective reaction is to seek to bring in an active, cognitive self, said Novotny.

After these powerful introductions, the floor was open to discussion – revealing the many different points of view. The Muslims, broadly speaking, were unhappy about direct attacks on science. 'The tremendous wealth of scientific knowledge must be treasured,' said the chairman, 'but it must be given its moral and religious dimension.' Science cannot create religion, and man cannot create religion for himself. But to discover the laws of nature is itself an act of worship. The central issue is *the failure of (the Christian) religion to nurse science*, he argued.

Parvez Manzoor then drew attention to certain 'Freudian slips' in the presentations of Ravetz and Novotny, which revealed their Judaeo-Christian background. The speakers had inadvertently equated science with knowledge, and knowledge with the Fall of Man. There is a 'thread of pessimism' in the Judaeo-Christian traditions, he said: 'a distaste for matter'. Islam does not share this pessimism, and in this respect has something in common with Marxism, said Manzoor. In Islam, there is a pride in God's creation, M.H. Sadr added: when God had created Adam, He showed him proudly to the angels.

In another direction, there is a greater reliance on *mystery* in Christianity than in Islam, said Manzoor. The Qur'-ān speaks of the miracle of the commonplace; in Christianity a miracle is a *unique* event.

However, according to James Counelis – the Eastern Orthodox Christian present – this was to caricature Christianity through Roman Catholicism; the Orthodox faith is optimistic like Islam, he argued. It has no concept of original sin. And moreover, the point was made that the

concept that the world and matter itself are sinful is in fact an old Christian *heresy*: Manachaeism.

The middle game

These formal opening moves characterised the seminar. But the arguments grew into a complex middle game, rather like the development of a game of chess. Out of that, a central stratagem gradually emerged: to analyse, through Islamic concepts, the staggering ethical problems raised by certain technical developments in the West. However, this only became clear towards the end of the seminar: to extend the analogy with chess, it amounted to the end game, but the game was never finished. It is difficult to do justice to the arguments of the middle game – which spread over many fields, but eventually arrived at this point. But here we sketch a few of the arguments. The end-game is described later on.

Walter Patterson, an experienced participant in the nuclear energy debate in the West, used that experience to develop general issues raised earlier. Rejecting the conventional approach to energy policy, he described a 'new energy philosophy' which he believed could be resonant with Islam.

The real energy problem in the West is neither technical nor economic, said Patterson, but institutional. Conventional energy strategies tend to involve undertakings which are large-scale, long-term, centralised, interdependent, rigid and brittle. This structure even determines the vocabulary in which energy policy is discussed, so that words like 'production', 'consumption', 'supply', 'demand' and 'efficiency' are loaded words in which the institutional structure is assumed as a fact. By contrast the new energy philosophy favours smallness of scale, diversity, the use of local materials, skills and money, local planning and control, with the objectives of flexibility, resilience, great reliance on ambient energy and high thermal efficiency. (In illustration of the latter, Patterson quoted Lorius, who identified three ways of making a structural material out of gypsum: to compress it into blocks, calcine it at 1200 degrees centigrade, or feed it to a chicken.)

To 'get there from here' there would have to be changes not so much in science as in energy organisations, their financial ground rules, social context, and areas of responsibility. Such changes would be resisted 'particularly by those sections of society whose influence and power would thereby be reduced'. Even research and development is affected: how do you decide what to study? You consider who will pay you for what, Patterson answered.

Thus energy technology – one important aspect of science and technology in society – must be considered in a context which takes these political factors clearly into account.

But in particular – Patterson stressed – the 'new energy philosophy', epitomised by Gerald Leach's work and the Ford Foundation studies, was one to which the Islamic world view is well-suited.[2] In this philosophy 'there is no longer an aspiration to conquer nature, but to live in harmony with it'.

These ideas led El Naggar, apparently unhappy with the idea of the social control of science, to insist that individual accountability was an excellent control over science and technology: that every human is responsible for his own deeds. M. Ali Kettani also remarked that knowledge itself is neutral. Only the use that is made of that knowledge is not neutral, said Kettani.

Kettani's remark in turn disturbed Ziauddin Sardar, convener of the seminar, who has roots in both Western and Muslim camps. In a brief reply to Kettani, he made what proved to be a key point in the seminar. There are concepts in Islam such as *Ilm* (knowledge); *adl* (justice); and *Zulm* (cruelty), Sardar pointed out. The question to be faced by Islam is what science produces *Zulm*? This question of relevant Islamic concepts was ignored at the time, but, developed later by Ralph Braibanti, it led ultimately to the 'end-game' of the seminar.

For M. Husain Sadr – also a man of West and East – it was important to recognise that the seminar was discussing the *Islamic* point of view, not what is happening in the Muslim world. (This is like distinguishing Christianity and the West.) 'I am very disappointed in Saudi Arabia and Pakistan,' said Sadr. 'Are they following an Islamic science policy? No. Their universities are built on Western models.' Also, as these countries are not so developed, they do not have the technologies that cause problems in the West: two reasons why there was no Islamic analysis of technological problems in the Muslim world. But if this seminar could bring out the implications of the Qur'ān, it would be of benefit to all, Sadr felt.

The following day, M. Ali Kettani, director-general of the Islamic Foundation for Science, Technology and Development (IFSTAD), presented his historical analysis of science and technology in Islam. Its conclusion: that Sadr's problem – the Islamisation of science and technology policy – is central to Muslim development.

The marriage of science and technology is one of the basic characteristics of modern times – it was almost absent in classical Greece and Rome. It was given its first great impetus during the golden age of Islam, Kettani argued.

Science in the West grew out of conflict between science and the Christian church, which in the middle ages 'held scientifically wrong concepts as absolute divine truths, and persecuted mercilessly, with sword and fire, whatever scientist tried to challenge these "truths"'. Thus, in the

West, 'there could be no development of science and technology without the removal of the Church from public life and the complete separation of the temporal from the spiritual'. This led to a secular materialistic Western culture – whether socialist or capitalist.

But in Islam there was no such schism: Islam emphasises unity. Thus science flourished with Islam and diminished with its decline, whereas the opposite occurred in the West. It follows that Islam has something to tell the West about the proper relation between religion and science.

This summary is not the place to go in detail into Kettani's description of the origins and nature of the Islamic faith. But certain aspects are particularly relevant to the point at issue. Islamic unity encompasses man's personality, said Kettani. There is no division between body and soul, a division which creates a high degree of hypocrisy in the West. The temporal and spiritual are just two facets of one single entity. Man should, in all he does and says in his life, obey the word of God. Thus the word 'religion' as used in the West cannot be applied to Islam. Islam is a *din;* more than a faith, a social and political order as well.

God has given Earth in trust to mankind. Man should therefore use this trust properly by doing good. Thus developing a technology, for example, which by definition manipulates the world and affects mankind, is in itself an act of religious significance. The guideline given to the Muslim is to seek the good of the community (and of humanity as a whole) and to use good and lawful means to reach that end.

Reason is given its full due in Islam; there is great respect for the truth-seeker (researcher) and great tolerance towards him. 'Let there be no compulsion in religion; Truth stands out clear from error . . .' Kettani quoted from the Qur'ān.[3] In the golden age, scholars and scientists were welcomed by Islam whatever their faith, and no attempt was made to convert them. 'Islam does not teach the suppression of thoughts, only of wrong acts.'

Kettani sketched the immense achievements of Islamic science in that period, which went well beyond the role usually attributed to it by the West (i.e. the transmission, through Arabic, of classical Greek and Roman achievements; the importance of Islamic science has clearly been ignored by most Western historians). The achievements of Islamic science – which will not be listed here – are important for the values that made them possible: universalism, tolerance (willingness to embrace all mankind as brothers), and respect for science and the scientist. The scale of the Islamic world, and the market that went with it, also played its part.

But this science fell with the culture, which decayed when Muslims began to act not on the basis of 'ordering what is good, forbidding what is bad, and believing in God', but as if merely the fact of being *Muslim* gave them superiority over other nations. 'This led to complacency and

the loss of the ideals that led to the birth of the Islamic civilisation in the first place.'

Meanwhile the Christian West freed itself from its under-development, and it was only a matter of time before the Muslim world found itself lagging in the course towards knowledge. The universalism of Islam was the first victim: the Muslim world was first Balkanised, and then began to be absorbed into Western universalism. Tolerance also vanished, new ideas were persecuted and 'scientists' began merely to study the ancients. Seeking knowledge was reduced in no time at all to seeking 'religious' knowledge, and eventually the sciences were dropped from the universities (Al-Qarawiyeen of Fes, Al-Azhar of Cairo, Al-Zaytounah of Tunis, etc.) which became uniquely religious institutions.

The potential rebirth of the true values of Islam, and of its science and technology, is a relatively new idea, said Kettani. It may bear fruit through the Organisation of the Islamic Conference, and its offshoot, IFSTAD, which is required in its charter to be 'conscious of the rich historical experience of the Muslim world in the field of science and technology, and of the need to foster the distinctive Islamic culture which combines the universal spiritual and moral values of Islam with the worldview of science'.

Discussion clarified one of Kettani's points regarding the essential historical division between Western science and Christianity. Roy Macleod reminded the seminar that many of the chief architects of Western science were in fact highly religious men – for example Bacon, Newton and Faraday. The point required a distinction between Christianity and the Church, said Parvez Manzoor.

MacCleod was also at pains to protect the reputation of Western science–historical scholarship: this was taking Islamic sources into account, he said. But, said Ketanni, the first European scientists denied the origin of their ideas in Islam, while they were happy to embrace the Greeks. Western science began in Spain, Sicily and Italy – at the edge of Islam, Kettani argued, and only then to the rest of Europe 'and the nations of the sea'.

According to Helga Novotny, Western science once incoprorated universalism and tolerance; 'but now the market has taken over'. Knowledge is now narrowly defined in utilitarian terms. One must look at the institutional structure of science; science has moved wherever there were institutions fitting to it. In Islam, said Manzoor, the issue of man's proper use of nature was dealt with in this way: man is granted power over nature, but he is not the owner of nature; he is a *trustee*.

Sardar then posed four questions: How is the public interest taken into account in Islam? In respect of 'universalism', is the domination of Islam better than the domination of the West? Are not domination and

'trusteeship' contradictory? And what form, exactly, would an Islamic policy take?

According to Kettani, it is an Islamic duty to develop the welfare of the community, and to implement something harmful is a sin. There is a distinction there between science (knowledge) and technology (its use). And Islamic universalism encouraged equality in diversity, whereas Western universalism is aggressive (consider the American Indians and the Africans). Sardar's other questions remained unanswered.

Walter Patterson, tiring of abstractions, then struck a more personal note – that 'science' in the abstract may be associated with many fine values; but *scientists*, however apparently 'pure' their research, are often working in a very questionable context. For example a theoretical chemist may be working on a binary nerve gas; or a physicist concerned with solid state energy levels may be working in a cruise missile programme. 'We must respect science and technology but criticise the abuse of it,' replied El Naggar. 'What is lacking in the West is a sense of responsibility and accountability to God.'

'Not only to God, but *to the public interest*,' emphasised Sardar. This was a cue to Ralph Braibanti, an American expert on Islamic studies, to identify a key issue: the matter of comparing value systems between Islam and the West. He drew attention to 'Harold Lasswell's scheme' which sought to find comparisons between cultures regarding certain essential ideas: power, enlightenment, wealth, being, skill, affection, respect and rectitude. 'These are so hyper-general as to be almost meaningless,' said Braibanti; but on the other hand, there would be agreement on their essential meaning in cultures as different as the Swedish and the Saudi-Arabian, he said. An important question for this seminar, said Braibanti, would be to apply this list to issues concerning science and technology.

Revetz then asked for a list of Islamic values to match Braibanti's, which launched the seminar into its end-game.

The end-game

The concept of God Himself first threatened the seminar. 'Do we agree', asked Manzoor provocatively 'that the source of all values is God?' Earlier, Kettani had remarked that only when Western scientists had begun their own search for religion could a true dialogue with Islam begin. But Nassir El-Din El-Assad, President of the Royal Academy of Islamic Civilisation Research, Amman, and an adviser to King Hussein of Jordan, saved the situation. 'Can we avoid theological points and creed?' he asked. Time was short. 'We should limit ourselves to seeking the values in Islam which can deal with the crisis in the West.' So this was the direction of the remainder of the seminar.

However, Munawar Ahmad Anees, a biologist of the University of

Indiana, first had a paper to deliver which raised immense issues. We shall leave aside Anees' metaphysics, an anti-reductionist position based upon the observation that the sequence of base pairs in the DNA of a living organism is not determined by merely local laws, but by the whole organism. Rather, Anees' most influential remarks concerned the extraordinary medical powers of the new biology – particularly manipulation of sperm, the ovum and the genome. These powers bear directly and heavily on men and women at every level. At the seminar they gave tangible substance to the earlier abstract moral, ethical and religious arguments, and although not unfamiliar they electrified the meeting – particularly the Muslims present.

The US Supreme Court had recently had to decide on the paternity of a child born by artificial insemination, said Anees. Was it the natural father, or the mother's husband? The court ruled that the child was illegitimate. So what of the child's rights, particularly its rights to support from its 'fathers'? And then what of fertilisation in the test tube? How were we to treat the possibility of genetic intervention, where – through amniocentesis – a genetically diseased foetus is recommended for abortion? Or the possibility of genetic repair to an embryo? Or of eugenics? (This was not dead, but very much alive, said Anees: witness the commercial American gene bank of Nobel-laureate sperm.) There are, of course, many other issues raised by the new biology; Anees simply touched on these few as examples. How would Islamic science policy deal with them?

Ravetz said that Anees' 'deep questions of value and ethics' reached a level where a scientist could ask: if that experiment is done, will the effects be too dangerous, given the present state of civilisation? 'It's almost like having another bite of the apple,' said Ravetz (who thus unconsciously echoed Manzoor's remark earlier in the seminar regarding the pessimism of the Judaeo-Christian tradition concerning knowledge).

Patterson took this chance to go further on the personal ethics and motivation of scientists. Taking nuclear physicists as his example (early in his career Patterson was one himself), he argued that it was precisely *because it was difficult and dangerous* that such people were attracted to the field. The Bikini island tests (of the H-bomb) gave them the feeling that they belonged to an inner sanctum of initiates, that they had a high status in society. 'It is that psychology of nuclear scientists that needs investigating,' said Patterson. Moral criteria have to be applied by each scientist. Joseph Rotblat had taken such a decision when working on the Manhattan project (to build an A-bomb) in 1944, said Patterson, 'When it was clear to him that the war would end, he resigned.' Thus Patterson was coming remarkably close to the fundamentally religious position of El Naggar, relying on the piety of the individual.

Kettani admitted that Patterson's and Anees' examples were 'shocking'. 'But the notion of shying away from knowledge is abhorrent in Islam.' Sam Nilsson, the director of IFIAS, agreed: 'Like Ali Kettani, I don't believe in moratoria in science,' he said. 'The crisis of science in the West is that it is institutionalised and commercialised.'

Braibanti then brought affairs back to concepts. 'What system of Islamic values would solve Anees' problems, he asked. Novotny and MacCleod returned to sociology and institutions: what is there in the social system of seeking knowledge in Islam that would be different? asked Novotny, and is there an alternative institutional structure? asked MacCleod.

Finally these questions led to a list of Islamic concepts by which science and technology might be judged.

Tawheed	The unity of God, mankind; *The* fundamental concept of Islam
Khilafah	Trusteeship
Ilm	Knowledge (Both a concept and a value)
Ibadah	Worship
Taqwa	God-consciousness
Adl	Equity, justice
Zulm	Oppression
Halal	Allowed (The meaning is more profound but untranslatable)
Haram	Forbidden
Istislah	Public interest
Dyah	Waste

Anees' questions could thus be treated at a first level of approximation simply by asking at what stage could *Halal* knowledge be transformed into a *Haram* action? And in relation to technology and its social effects, one could ask what technology creates *Zulm*? And does it lead to *Adl*?

This encouraged Ravetz to say that the Westerners at the seminar had thus learned that there were indeed relevant categories in Islam, and that judgements could be reached that were positive or negative. 'We have seen that the exercise can be done.'

Ali Kettani then added an insight, and effectively concluded the seminar, by arguing that both the ends and means of science must conform to the value system of Islam. In other words, both the production of science and the use to which it is put must be based on Islamic principles. In the golden days of Islam, science was pursued within the ethical boundaries of Islam and there were controls and checks to ensure that individual scientists were contributing to the total welfare of the community, Kettani said. It was natural, therefore, for the end products of their research to yield only socially beneficial results. We have lost this system of research as a consequence of degeneration of Muslim society, said Kettani.

Kettani's remarks produced a genuine piece of synthesis after three days of deliberation. Both the Muslim and Western scientists and scholars agreed that the whole enterprise of science should be geared towards the production of such cherished values as social justice, public interest and trusteeship.

Epilogue

A great deal, then, was learned on both sides in Stockholm, whatever scepticism was left about each other's point of view. For this reporter and commentator, for this offspring of Christendom, the lasting impression was of the receptivity of Islam to science: it was extraordinary and beautiful to find a *religion* which embraces the objective search for truth so warmly. All forms of knowledge must be complementary, as there is only one world to describe; so religious experience is an aspect of reality, it must unite with science. The union must be constructive, at least insofar as each system of knowledge contains truth. But historically, institutional Christianity has often been in conflict with science, to the great loss of both sides. Christianity has suffered from being caricatured as obscurantist, while science has been de-humanised.

In Islam, it seems, there are some lessons, if only Muslims can absorb the concept of the frailty of the expert. This could only happen if they could see 'expert' error and bias as another aspect of the failure of man to reach his ideal religious goal. And this would admit error among the most devout and influential Muslim scientists and scholars – not to mention the *ulama*. So, finally, we return again to the initial question, to the crux of the matter: the question of truth and power. In Islam, the cult of the expert gave (and gives) great power to the *ulama*, just as the cult of the expert gives great power to the technocrats of the West.

Is this a full circle? I hope not. I think that we have learned at least one lesson: that ultimately, the true struggle is to separate and see clearly knowledge and power – in *all* its earthly, cultural settings.

References

1 One thinks of J.D. Bernal, and – for example – the concept that objective measures of intelligence were a force for socialism, as they should destroy unfounded privilige. It's an idea that runs through his *Science in History* (4 vols) Pelican, 1965.

2 See Gerald Leach, Christopher Lewis and Frederic Romig, *A Low Energy Strategy for the United Kingdom*, International Institute for Environment and Development, London, 1979.

3 The Qur'ān: 2–256.

THE OTHER INDIA PRESS

Ziauddin Sardar

The Touch of Midas

Science, values and the environment in Islam and the West

Science has played a vital role in the development of Islamic and Western civilisation. In Islamic countries, as in the West, science has been used to obtain unimaginable riches and to organise and improve life. The nature of the scientific enterprise has however been quite different, and this is evident in the character of the environments which these two civilisations have created.

In this critical re-examination of science, the contributors reflect on the relationship between science and the moral values of society within Christendom and Islam. Attitudes towards the environment within the different cultures are contrasted and, finally, an attempt is made to derive a synthesis of the two sharply differing world-views.

About Ziauddin Sardar

Ziauddin Sardar is a distinguished commentator on science and technology and a prolific writer and broadcaster. His most recent book is *Cyberfutures* (with J.R. Ravetz). His earlier books include: *The Future of Islam; Islamic Futures: The Shape of Ideas to Come; Distorted Imagination* (with Merryl Wyn Davies) and, *The Blinded Eye.*

Contributors:

Munawar Ahmad Anees • James Steve Cornelis
Helga Nowotny • Alison Ravetz • Jerome R Ravetz
Lloyd Timberlake • Robert Walgate • M Husain Sadr
Glyn Ford • Gulzar Haider • M Ali Kettani • Parvez Manzoor

The Other India Press
Centre for Studies on Science

ISBN No: 81-900229-6-2

IB Rs 200